SCIENTIFIC AMERICAN

[Entered at the Post Office of New York. N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION. ART. SCIENCE. MECHANICS. CHEMISTRY AND MANUFACTURES.

Vol. XLVI.—No. 19. [NEW SERIES.] NEW YORK, MAY 13, 1882. $3.20 per Annum [POSTAGE PREPAID.]

THE KINZUA VIADUCT.

We give an engraving of the largest railroad bridge in America, now being erected by the New York, Lake Erie, and Western Railroad. It is situated in the middle of McKean County, Pa., four miles from Alton, the present terminus of the Bradford branch of the Erie road, and crosses the Kinzua Creek at an elevation of 2,100 feet above the level of the sea.

For many years the valley of the Kinzua has been an obstacle to engineers in locating a road between Buffalo, N. Y., and Pittsburg, Pa. The banks on both sides form steep slopes, and are covered by a dense growth of heavy hemlock trees. The stream itself is small and shallow, but flows through a deep ravine from its source until it empties into the Allegheny River.

Various surveys have been made from time to time for the purpose of finding easy grades and good alignment, but with no definite results until two years ago, when it was proposed by Mr. O. W. Barnes, of New York, to cross the valley by an immense viaduct.

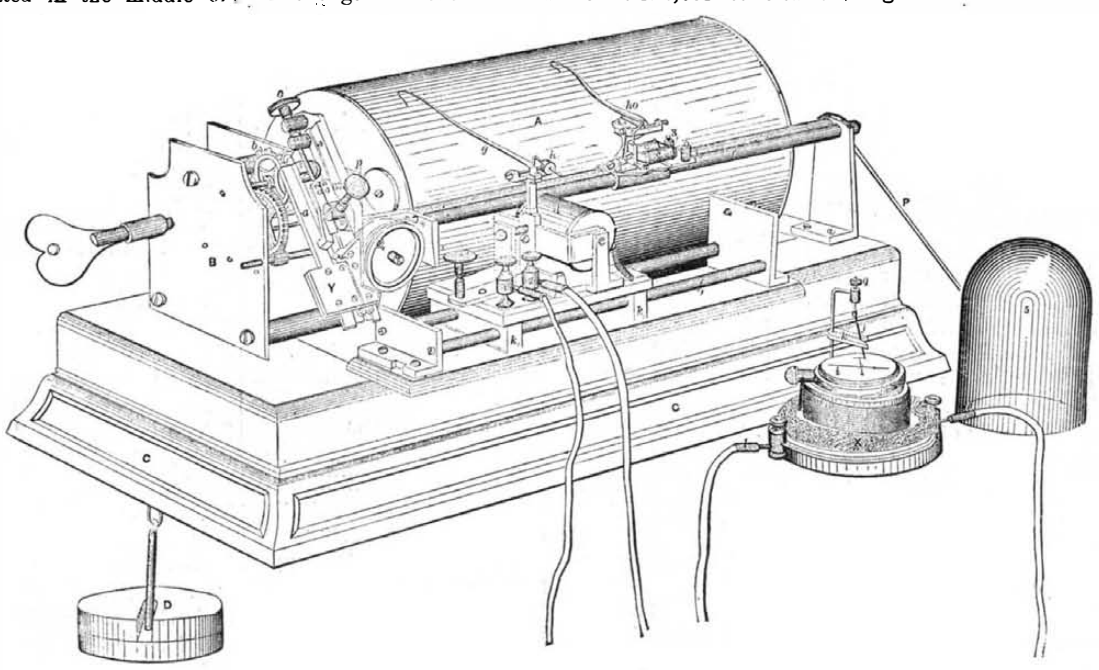


Fig. 1.—CHRONOGRAPH FOR ENGINEERING PURPOSES.—[See Page 291.]

Mr. Barnes, who at that time was Chief Engineer of the extension of the Bradford branch of the Erie, having received the approbation of the company to carry out his plans, selected a suitable place to span the ravine, and made the calculations for strains and windage, aided by his able and energetic assistant. Mr. Charles Pugsley.

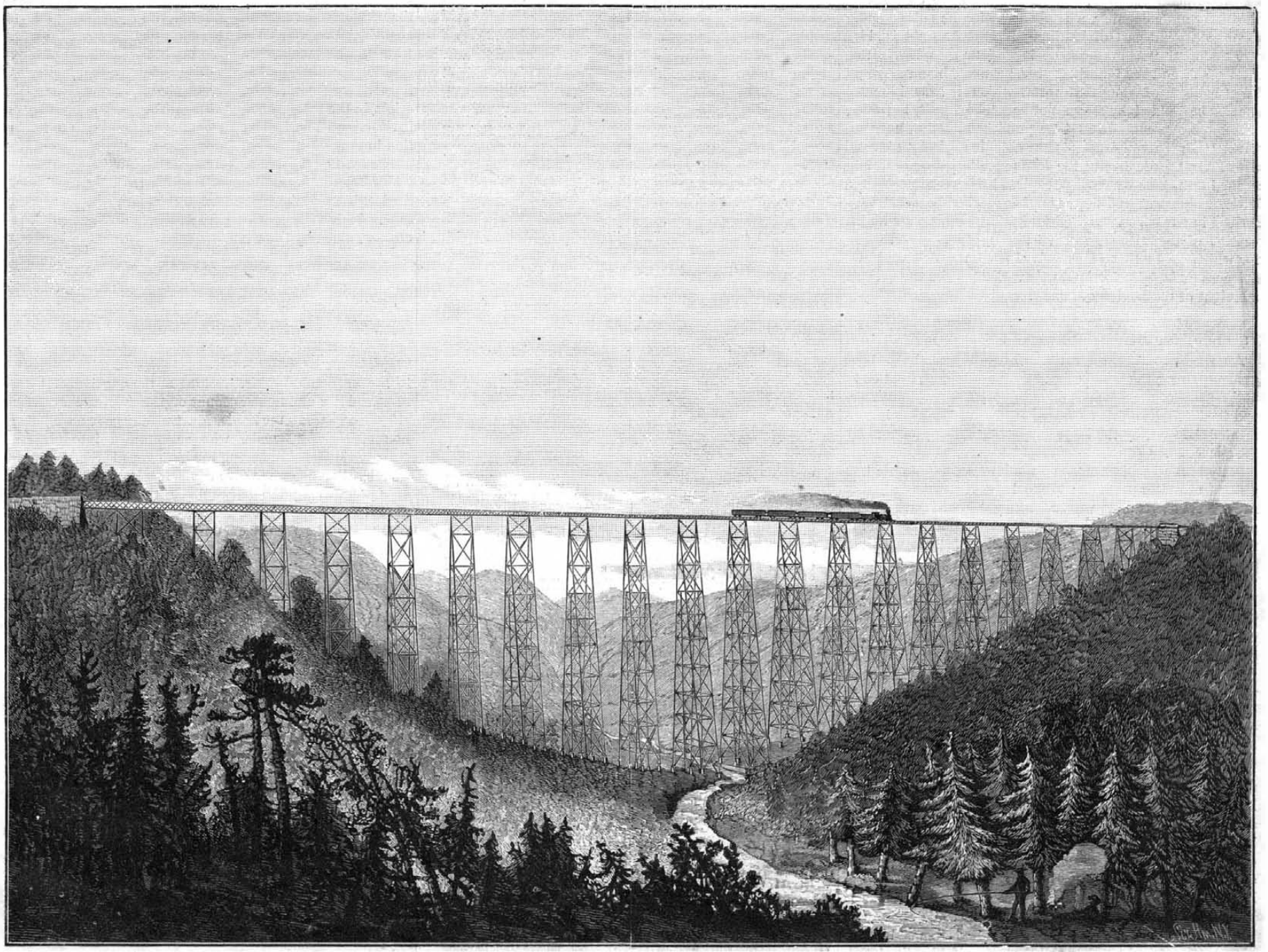
The length of this immense structure is 2,051 feet clear of the abutments, and the height is 301 feet from the bed of the stream to the base of rail. There are twenty spans 61 feet long, and one 62 feet long, alternating with the tower spans, which are 38½ feet each. The truss being 6 feet high and 10 feet wide, and continuous from one end to the other, is supported by columns 1 foot thick, which increase in length toward the middle of the bridge. They spread out with a batter of 2 inches to the foot, which gives a distance of 10·5 between the columns of the highest bents at the bottom. The two longest bents rest on two long piers with pedestals, built on either side of the stream, each containing about 500 yards of masonry.

All the other columns rest on separate piers containing from 20 to 125 yards of masonry.

Foundations for the most part are built on solid rock; only in a few piers near the bottom where timbers have been used. They average about 14 feet square on the bottom, and batter in to a coping of 4 feet square on top and 2 feet in thickness.

The iron shoes, to which the columns are fastened, are embedded in the copings, and each one is anchored to the pier by two large bolts passing down through to a manhole in one of the bottom courses, where they are made secure by an iron plate and nut. These bolts are put in to counteract the influence of the wind.

An excellent quality of sandstone has been found in the



KINZUA VIADUCT.—THE HIGHEST RAILWAY BRIDGE IN THE WORLD.—[From a Sketch by John Toomey, Assistant Con. Eng.]

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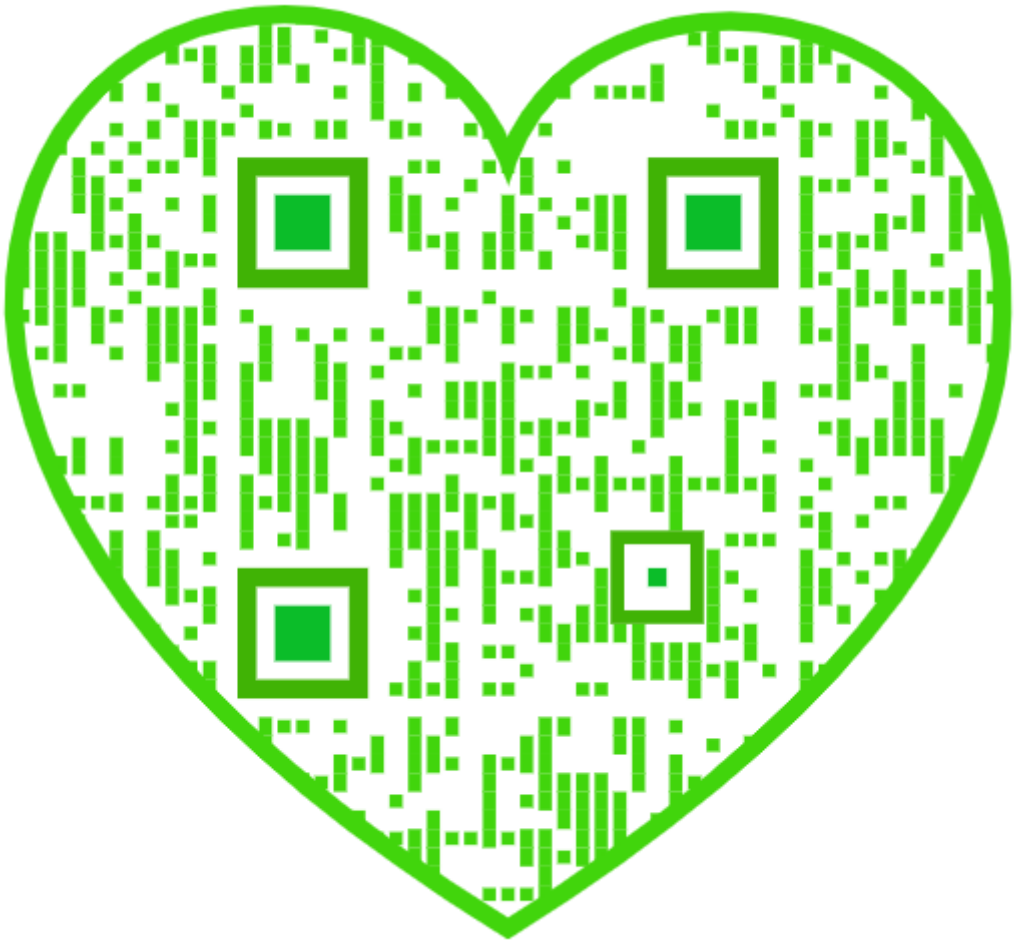

immediate vicinity of the bridge, which proved quite beneficial to the contractor of masonry, Mr. John G. Noakes. Four million pounds of iron and 7,000 yards of masonry will be consumed in the construction of the viaduct. It will cost not far from $300,000.

Work was commenced last August, and will be finished next August, about the same time that the grading will be done. It will be 60 feet higher than Niagara Suspension Bridge, 170 feet higher than the great bridge across the Ohio at Cincinnati, 189 feet above High Bridge, 170 feet higher than the East River Bridge, and 45 feet higher than Portage Railroad Bridge over the Genesee River.

The officials connected with the road are: O. Chanute, chief engineer; Chas. Pugsley, P. A. eng.; C. H. Keefer, div. eng. in charge of viaduct; Wm. Seaman, resident engineer; and C. E. Ball, inspector of masonry; Barnes & McFadden, contractors. The iron for the bridge is furnished by the Phœnixville Bridge Company, and erected by R. A. Simmons.

Heating by Sunshine.

Professor E. S. Morse, of the Essex Institute, has devised an ingenious arrangement for utilizing the heat in the sun's rays in warming our houses. His invention consists of a surface of blackened slate under glass fixed to the sunny side or sides of a house, with vents in the walls so arranged that the cold air of a room is let out at the bottom of the slate, and forced in again at the top by the ascending heated column between the slate and the glass. The out-door air can be admitted, also, if desirable. The thing is so simple and apparently self-evident that one only wonders that it has not always been in use. Its entire practicalness is demonstrated in the heating of the professor's study in his cottage at Salem. The value of the improvement for daily warming buildings like churches and schoolhouses, which, when allowed to get cold between using, consume immense quantities of heat before they are fairly warmed again, is evident. Of course some other means of heating must be available when the sun does not shine. But in the colder regions, say in the far Northwest, the sun shines a greater part of the time, and hence the saving of artificial heat would be very large if the sun heat could be "turned on" for eight or ten hours out of the twenty-four.

Giffard.

Mr. Henri Giffard, inventor of the injector, is dead. He was born in Paris, on February 8, 1825, and he was thus but a little over 57 years of age at the time of his death. In 1841 he became engaged in the works' offices of the Paris-Saint Germain Railway, and shortly after he commenced the study of ballooning, a study to which he subsequently devoted a great part of his life. In 1851 he published his work entitled "Application de la Vapeur à la Navigation Aerienne,' and the following year he made his first ascent in a balloon of elongated form, which it was intended should be guided by steam power. The result, however, was not a success. In 1854 he published another book entitled "Du Travail depense pour obtenir un Point d'Appui dans l'Air," while during the Paris Exhibition of 1867, and again in 1878, he established captive balloons at Paris, the latter, which was of enormous size, having been fully described in our pages. Mr. Giffard is best known by his invention of the injector, which he brought out in 1859, and for which he in that year received from the Academie des Sciences their prize for mechanics. In 1863 he was created a Knight of the Legion of Honor.

Some of the Beneficial Effects of Electric Lighting.

An English writer, after describing the baneful effects of gas lamps upon the healthfulness of living rooms, goes on to notice some of the mischief done to books, wares, furniture, and the like. The evil effects of the heat of gas jets is augmented, he says, by the large amount of water produced by the gas flame.

Sixty burners will produce on the lowest computation two gallons of water per hour; hence in a November evening many large shops filled with delicate goods will have a nine-gallon caskful of water thrown into their atmosphere in the form of steam, to condense on any cool surface, as we often see it trickling down the windows in winter. But worse remains behind. The sulphur, always present in gas in larger or smaller proportion according to the character of the coal employed, burns into sulphurous vapor, which passes in the air to the state of oil of vitriol. The eminent chemist, Dr. Prout, exposed water in a drawing room in which gas was burnt, and found that it absorbed sufficient of these vitriolic emanations to redden blue litmus and show the presence of free sulphuric acid. The fumes from gas will indeed, in the long run, discolor every sort of fabric, rust metals, rot gutta percha, and reduce leather (as in the binding of books) to "a scarcely coherent powder with a strongly acid taste." After referring to the evidence of the librarians of the Atheneum Club, London Institution, etc., as to the rotting of the bindings of books kept in rooms lighted by gas, the writer says: "Drapers know to their cost how the edges of pieces of dyed fabrics become faded and rotten when kept long on the upper shelves of gas-lighted shops; no plant will grow in a room where gas is burning, and cut flowers quickly wither; while those who work long and habitually in gas-lighted rooms become blanched and sickly. From all these manifold evils electricity will deliver us."

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 261 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, MAY 13, 1882.

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THE LIBYAN DESERT.

A closer study of the geological structure of the Libyan Desert is likely to change the views previously entertained regarding its origin. Prof. Zittel, in a lecture delivered in Munich, said that the scientific expeditions to that region, undertaken by Rohlfs, Zittel, Ascherson, and Jordan, have yielded a paying harvest in geology at least. We learn that this region, the geology of which was so little understood, as well as the so-called Arabian Desert, which lies between the Nile and the coast of the Red Sea, and which is inseparable from the Libyan Desert so far as the stratifications are concerned, is not, as has been generally supposed, the remains of a sea that has recently disappeared. On the contrary, it consists of formations that belong to the cretaceous and lower tertiary, formations long anterior to the geological present. The rocks of the cretaceous, which prevails, are principally sandstones, variegated marl, calcareous marl, and limestone; the cretaceous fauna was found to be extraordinarily richly represented, as rarely happens elsewhere, such as oysters, ammonites, sea urchins, etc. In the oldest tertiary the nummulites formed deposits, so called because the petrifactions which they held were considered by the common people to be petrified coins. There are shells of foraminifera from the size of a pea to that of a dollar, and elsewhere in the lowest layers of the tertiary they appear in immense masses. The soil of the desert is covered with them for miles.

With the exception that in the middle tertiary the sea pressed inward on the north in two comparatively unimportant depressions, every trace of any later sea is wanting.

The whole Sahara as well as the Libyan seems to belong, for the greater part, to the chalk formation, and while the older *stratified* rocks are wanting eruptive rocks appear, forming mountain chains.

Hence there can be no talk of the sea having covered the Sahara in the recent past, for if this were the case there would be later stratified rocks on top of the cretaceous with fossils resembling the marine fauna of the present time. Then, too, the surface of the desert is not of such a shape as to indicate that it has been the bottom of the sea; but, on the contrary, the torn, ragged, fissured chasms of the desert mountains, the deep cut valleys, indicate the erosive action of flowing waters which, perhaps, in the oldest historic times still lent luxuriant fertility to the region now so sterile. This sterile character of the Sahara is to be attributed entirely to the unfavorable meteorological conditions, to the almost total lack of rain. The soil itself is well adapted to the production of a rich vegetation.

The quantity of salt present in the collections of water rendering many of the oases uninhabitable, depends upon the rock salt, which, with gypsum, is very abundant in the chalk marl as well as elsewhere. The ascending thermal waters, which make a paradise in the midst of the cheerless desert, according to Zittel's investigations, are not, as was formerly supposed, referable to the Nile, but have their origin in the rainy zones of Central Africa, whence they are led northward on impenetrable strata that have an inclination in that direction.

The sand of the desert is from the "Nubian sandstone," which belongs to the cretaceous formation and extends along the left bank of the Nile through the tenth degree of longitude. It has been transported hence by ancient water courses, aided by the wind.

The National Academy of Sciences.

The announcement that Mr. J. H. Cushing would read a paper "On the Mythology of the Zunis" drew an exceptionally large attendance upon the meeting of the Academy, April 20. The six Zuni chiefs were present, and were introduced to the audience by Mr. Cushing at the opening of his address. After giving an account of the intricate system of priesthood among the Zunis, Mr. Cushing gave an enumeration of the Zuni gods, who are divided into six great classes. Interesting among the hero gods is the great priest of all religious orders save one. He is supposed to have appeared among the ancestors of the Zunis, so poor and ill clad as to have been ridiculed by mankind. He it was who taught the fathers of the Zunis their architecture and their arts; their agriculture and their system of worship by flames and painted sticks; but, driven to desperation by the ingratitude of his children, he vanished beneath the world, never to return to the abodes of men; yet he still sits in the city of the sun, ever listening to the prayers of his ungrateful children.

The address was followed with many interesting illustrations of a poetical character of this strange people. The other papers for the day were as follows: "On the Polarization of the Light of the Moon," by A. W. Wright; "On the Results of the Incandescent Lamp Tests at the Paris Exhibition," by G. F. Barker; "On the Formation of Metalliferous Vein Formation at Sulphur Bank, California," by Professor Joseph LeConte; "On a Form of Standard Barometer," by A. W. Wright, and "On a Marsupial Genus from the Eocene," by Professor E. D. Cope. On the last day one new member was elected—Prof. Ira Remsen, of Baltimore.

ANOTHER ELECTRIC RAILWAY.—The second electric railway constructed by Messrs. Siemens and Halske in Berlin was formally opened, April 29. It runs from Lichterfelde, a suburban station on the Berlin-Anhalt Railway, to the Military Academy, about one and a half English miles.

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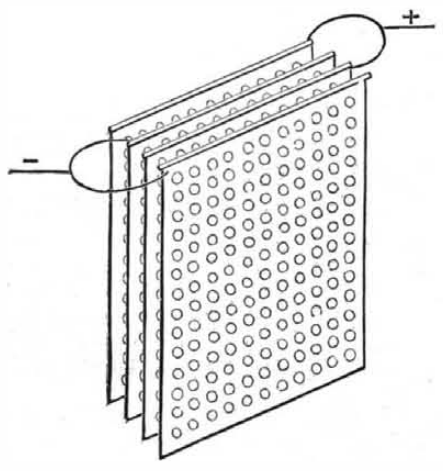
The Sellon and Volckmann Storage Battery.

Last week we gave a brief account of this new invention for the storage of energy, which is now in successful operation at the Electrical Exhibition, London. We now present further particulars, which we find in a recent number of *Nature:*

"The new accumulator of Messrs. E. Volckmann and J. S. Sellon, exhibited at the Crystal Palace Electrical Exhibition, in connection with the Lane-Fox system of electric lighting in the Alhambra Courts, has already been announced, but its construction has hitherto been kept a secret for reasons of patent right. The storing power of this new secondary battery may be gathered from the fact that 33 cells feed 201 Lane-Fox incandescent lamps, nominally of 20-candle power for seven hours at a time, if the battery is fully charged to start with. The actual light of each lamp, however, is nearer 30 candles; and it is found that these lamps, which are designed to bear a 20-candle current from the generator, will stand a 30-candle current from the accumulator owing to its more uniform flow.

"Each cell is stated to contain 5 horse power of energy acting for an hour, or 1 horse power for five hours, and so on. It consists of a series of metal plates of some alloy, each plate being five-sixteenths of an inch thick, and perforated with round half inch holes, as close as they can be punched or cast. These plates are connected alternately in series like the plates of a condenser, as in the figure, and joined to two



stout terminals, which are the poles of the cell. The holes are filled with a metallic paste, the composition of which is not yet divulged, but may readily be guessed, from the fact that metallic lead is reduced on the negative plates, and peroxide of lead on the positive plates. The spaces between the plates, which are placed nearly an inch apart, are filled up with water mixed with one-tenth part of sulphuric acid, to give good conduction. The whole is contained in a wooden trough about 30 inches square and 8 inches in thickness. The weight of each cell is about 375 pounds, including 295 pounds of the metallic composition which is the storing agent. The sparks given off on connecting several cells of the charged battery by a stout copper wire are remarkably violent, the deflagrated wire flying off in a perfect shower of red hot sparks of copper accompanied by loud cracks. On examining the wire afterwards, it is found to be literally torn asunder in small pieces by the force of the discharge. A considerable quantity of hydrogen is evolved from the cells.

"The exhibition of Lane-Fox lamps fed from this battery is without doubt the most brilliant display of incandescent lighting which has yet been made in this or any other country."

The *Engineer* has the following:

The new secondary battery, of which a good deal has been published without stating by whom it was made or invented or what it was like, was recently exhibited and shown in operation to the Prince and Princess of Wales in the Alhambra Courts of the Crystal Palace, by the Electrical Power Storage Company, of 74 Hatton Garden. The battery is the result of the labors of several inventors, among whom are Mr. E. Volckmann, Mr. Sellon, and Mr. Swan, and it is, it need hardly be said, entirely different in construction from the Faure battery, of which so much has been heard and comparatively little seen. For the purpose of the display, the Alhambra Court is richly furnished in the Moorish style, and electric chandeliers or candelabra have been specially designed by Mr. Johnson, a pupil of the late Owen Jones. Of the design of these fixtures and fittings we can only say that they must be seen to be appreciated. Altogether they carry 201 incandescent lamps, all of which are connected up to 33 of the new batteries out of 38 at present in an inclosed space next the engine and machine shed of the Brush Corporation. The 33 are connected up to a switch-board in such a way that the current from any number from about 10 to 33 may be put in circuit by simply turning the switch handle, and thus anything from a very dim to a very bright light may be used as required.

The cells each contain twelve elements, each about 20 in. by 15 in., and about $\frac{5}{16}$ in. in thickness, and placed in a box of about 25 in. by 16 in. by 7 in., the whole weighing about 370 lb., and containing about 295 lb. of metallic material. Each cell stores electric energy equivalent to about 5-horse power for one hour, which can be used at the rate of fully 40 ampères per horse-power, or say 200 ampères. The plates are closely perforated with holes about half inch diameter, the holes being afterward filled with a composition, the exact nature of which we are not yet at liberty to make known, further than to say that it is such that it expands when the plates are first polarized, and thus finds itself under a pressure sufficient to cause a considerable superficial extension of the positive plate. Perfect metallic contact between the composition and the material of the plates is thus permanently insured, so that the plates cannot become inactive by local action or by deposit of a salt of lead between the composition and the walls of its containing holes forming a solid mass of alloy. The plates are strong and are maintained at a very short distance apart by splines of wood, and stand with their longest dimension vertical. They are connected up to a plate on the top of the cell in a very simple way, the whole producing a perfectly satisfactory, efficient, and practical battery, having neither of the chief faults of the Faure battery.

From the figures we have given, and to which we shall add on an early occasion, it will be seen that the weight of the battery per one hour horse-power is about 60 lb. of metallic composition. To give off 400 horse power for one hour or 200 horse power for two hours would thus require about 10 tons of batteries, and for the 201 Lane-Fox lights in circuit, a little over 4½ tons were coupled up.

The Lane-Fox lamps are 20-candle power pushed to 30-candle power, so that the weight of battery coupled up was 1·65 lb. per candle, or 50·14 lb. per 30-hour candles.

It is generally acknowledged by electricians that without a satisfactory secondary battery domestic electric lighting cannot become general. This is not, however, confined to domestic lighting, but applies to lighting public buildings and to many other applications of electricity. Something must be had which in an electric lighting system, or in an electromotive power system, will take the place represented by the gasometer in the gas-lighting system and by the accumulator in a hydraulic power system. The battery which will do this is now provided, and the application of electric currents will probably make more rapid advance from this time than it has done even within the past three years. The new battery may be made to meet any requirements. It may be of small size to go into the place of the gas meter in a house, or in large masonry tanks for extensive public buildings and it will probably be made to fill very large tanks at central electric lighting and power-generating stations, so that smaller engines running continually may take the place of large engines running as at present only during the hours that lights are required. It will be possible to obtain a light or work an electric motor at any time by one movement of a handle, and the batteries will probably, in somecases, constitute the motor for domestic lighting. One of each pair of the elements or plates will last almost indefinitely, while the other will only require renewal when constantly in use about once in, say, fifteen months, as far as can at present be seen, and they may turn out to be made more durable. They are easily renewed, and the batteries require no attention whatever, except for a little filling up at long intervals of the acidulated water in which the plates are immersed.

The lamps were nominally 20-candle power, pushed to 30-candle power, the total candle power being 6,030 candles.

The Parasitic Nature of Tubercular Consumption.

Professor Tyndall has communicated to the London *Times* an account of results obtained by Dr. Koch, of Berlin, in the investigation of the etiology of tubercular disease, as set forth by him in an address delivered, March 24, before the Physiological Society of Berlin.

It was the aim of Dr. Koch to determine the precise character of the contagium which previous experiments on inoculation and inhalation had proved to be capable of transferring and reproducing tubercular consumption.

In pursuing these investigations Dr. Koch subjected the diseased organs of a great number of men and animals to microscopic examination, and found, in all cases, the tubercles infested with a minute, rod-shaped parasite, which, by means of a special dye, he differentiated from the surrounding tissue. It was, he says, in the highest degree impressive to observe in the center of the tubercle cell the minute organism which had created it. Transferring directly, by inoculation, the tuberculous matter from diseased animals to healthy ones, he in every instance reproduced the disease. To meet the objection that it was not the parasite itself, but some virus in which it was embedded in the diseased organ, that was the real contagium, he cultivated his *bacilli* artificially, for long periods of time, and through many successive generations. With a speck of matter, for example, from a tuberculous human lung, he infected a substance prepared, after much trial, by himself, with the view of affording nutriment to the parasite. Here he permitted it to grow and multiply. From this new generation he took a minute sample and infected therewith fresh nutritive matter, thus producing another brood. Generation after generation of *bacilli* were developed in this way without the intervention of disease. At the end of the process, which sometimes embraced successive cultivations, extending over half a year, the purified *bacilli* were introduced into the circulation of healthy animals of various kinds. In every case inoculation was followed by the reproduction and spread of the parasite and the generation of the original disease.

In the course of his experiments Dr. Koch determined the limits of temperature between which the tubercle bacillus can develop and multiply to be 86° Fah. and a maximum of 104°.

He concludes that, unlike the *bacillus anthracis* of splenic fever, which can flourish freely outside the animal body, in the temperate zone animal warmth is necessary for the propagation of the newly discovered organism. In a vast number of cases Dr. Koch has examined the matter expectorated from the lungs of persons affected with phthisis and found in it swarms of *bacilli*, while in matter expectorated from the lungs of persons not thus afflicted he has never found the organism. The expectorated matter in the former cases was highly infective, nor did drying destroy its virulence. Guinea-pigs infected with expectorated matter which had been kept dry for two, four, and eight weeks respectively were smitten with tubercular disease quite as virulent as that produced by fresh expectoration. Dr. Koch points to the grave danger of inhaling air in which particles of the dried sputa of consumptive patients mingles with dust of other kinds.

Commenting upon this important communication from Prof. Tyndall, the London *Times* points out the significant fact that though the experiments of Dr. Koch seem as yet to have been carried no further than to therepeated cultivation of the tubercle bacillus in its original virulence, they will speedily be followed, as a matter of course, by attempts at cultivation in diminished intensity. The evidence, even now, the *Times* continues, does not rest upon the labors of Dr. Koch alone, for Prof. Klebs, five years ago, declared the infective property of tubercle to be due to the presence of a microphyte (practically a synonym for bacillus), and Dr. Schüller, of Greifswald, a résumé of whose investigations was given by Mr. Simon to the International Medical Congress, has proved that the microphyte which characterizes turbercle characterizes, also, certain affections popularly called scrofulous, such as diseased joints and glands, and that inoculation from any of them, or with a fluid in which their microphyte has been cultivated, will infect with general tuberculosis. Dr. Schüller, according to the same authority, has also made proposals for the treatment of tubercle on the basis of its micro parasitic origin, and has shown the successful results of such treatment upon animals which he has inoculated.

The Recent Lawson Boiler Experiment.

To the Editor of the Scientific American:

Referring to the Lawson experiment (exploding boilers), on page 230, SCIENTIFIC AMERICAN, it is stated that there was twenty inches of water in the boiler. This, we infer, was at the commencement of the operation, as there was no means of supplying more water, and no means of knowing how much of that water was wasted or became steam previous to the explosion. The pressure is said to have been 235 pounds, representing a temperature of 400° Fah. Now the question in my mind is: In what condition was the water at 400° Fah.? Supposing the boiler strong enough to sustain twice the pressure and a corresponding degree of heat, is it possible for water to exist (*as water*) at a like temperature? It seems to me there must be a point or degree of heat where the water in a boiler—under like circumstances—will all become steam.

Will some one please give us more information on this subject through the SCIENTIFIC AMERICAN? and oblige,

WM. ORD.

Brooklyn, Ohio, May 1, 1882.

The Chalmers-Spence Fire.

The recent disastrous fire which occurred in the establishment of the Chalmers-Spence Company (Morgan Iron Works), New York, manufacturers of boiler coverings, will not interfere with the business of the company in the least, and all orders will be filled promptly as usual. The loss was about $50,000, mostly covered by insurance.

The Care of the Eyes.

At the recent Sanitary Convention at Ann Arbor, Mich., Dr. C. J. Lundy, of Detroit, read a paper on "Hygiene in Relation to the Eye," which should have the widest circulation, especially among teachers and school officers. A fruitful source of eye troubles is shown to be the excessive strain upon the muscles and nerves of the eyes due to faulty educational methods, the ill-planned and insufficient lighting of school rooms, poor ink and fine print in school books, and other causes, which education might correct.

In conclusion, Dr. Lundy lays down the following rules for the better care of the eyes:

1. Avoid reading and study by poor light.
2. Light should come from the side, and not from the back or from the front.
3. Do not read or study while suffering great bodily fatigue or during recovery from illness.
4. Do not read while lying down.
5. Do not use the eyes too long at a time for near work, but give them occasional periods of rest.
6. Reading and study should be done systematically.
7. During study avoid the stooping position, or whatever tends to produce congestion of the head and face.
8. Select well printed books.
9. Correct errors of refraction with proper glasses.
10. Avoid bad hygienic conditions and the use of alcohol and tobacco.
11. Take sufficient exercise in the open air.
12. Let the physical keep pace with the mental culture, for asthenopia is most usually observed in those who are lacking in physical development.

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Effects of Jets.

In 1826 a French engineer discovered that when a jet of gas flows through an orifice or nozzle under pressure, and a plate be held normal to the axis of the jet at a certain height above, it is repelled, whereas if held lower it is attracted; and there is a neutral point at which it is supported on the jet, and emits an audible note as it oscillates about this position of equilibrium. M. Th. Vautier has recently succeeded in evoking very high sounds in this manner and registering them. With a jet of steam having a pressure in the boiler of 4½ atmospheres, and issuing from an orifice of 2·7 mm. in diameter, against a plate 6 mm. in diameter and 1½ mm. thick, held 0·2 mm. from the orifice, the note obtained was La^6 sharp=7,250 single vibrations per second. An electro diapason was employed to register the vibrations—by means of a sharp style tracing a line on smoked mica.

To Europe in Less than a Week.

QUEENSTOWN, May 2.—The Guion Line steamer Alaska, Captain Murray, which sailed from New York on Tuesday, April 25, at 1:12 P.M., for this port and Liverpool, passed Fastnet at 3:20 o'clock this afternoon, having made the passage in 6 days 21 hours 46 minutes. The company claim that this is the fastest passage ever made by several hours.

The Inspection of Foreign Passenger Ships.

A bill was recently passed by the House of Representatives requiring the inspection of foreign vessels carrying passengers from American ports; and it is to be hoped that the Senate will not fail to pass a similar bill, as it did at the last session.

The urgent need of such inspection was forcibly stated by the representative from this city, the Hon. S. S. Cox. In the course of his speech he arraigned particularly a steamship company whose practice has been to use in the West India trade vessels whose extreme age and rottenness made it impossible for them to pass inspection anywhere. Flying a foreign flag, however, they were free from inspection in the ports of the United States, and were thus continued in service long after they had ceased to be fit to go to sea. Of this class of vessels the Bahama, which went to pieces in a slight gale off our Florida coast last summer, was a fatal example.

Mr. Cox pointed out the startling fact that during the past year the loss in vessels flying the British flag was $900,000,000. There were 144 steamships lost—151,000 tons!—with a total loss of life amounting to 1,459. Every day last year 5 vessels and 4 lives were lost on all the seas by reason of such disasters. Many of these losses were from foundering, overloading, bad stowage, structural defects, and bad machinery. Six vessels were abandoned at sea because they were utterly unfit. "So long," he said, "as we allow English vessels to escape inspection in our harbors we share the responsibility of this terrific loss of life. No life-saving service of ours which concerns stranding can guard against the body of these losses."

The bill passed provides that Section 4400 of the Revised Statutes of the United States be amended and enlarged by adding thereto at the end of said section, as it now appears, the words:

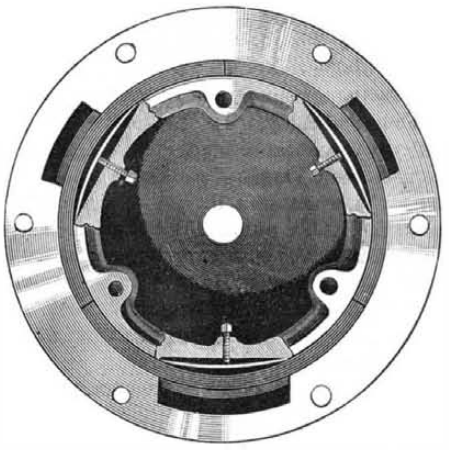
"And all foreign private steam vessels carrying passengers from any port of the United States to any other place or country shall be subject to the provisions of Sections 4470, 4471, 4472, 4473, 4479, 4482, 4486, 4488, and 4489, of this title, and shall be liable to visitation and inspection by the proper officer, in any of the ports of the United States, respecting any of the provisions of the sections aforesaid."

Boiled Milk.

To distinguish boiled milk from fresh milk the smell and taste are called into requisition, but only the experienced succeed in this. Quevenne's assertion that boiled milk does not coagulate as soon or as completely as unboiled is frequently incorrect. According to C. Arnold, in the *Pharmaceutische Archiv*, if a little tincture of guaiac is added to fresh milk a more or less intense blue color will appear at once or in a few minutes, and last a long time. More than twenty different sorts of milk were tried, and all gave the reaction without exception. By carefully warming the milk to 40° or 60° C. (104° to 140° Fahr.) the reaction took place at once; and also at 70° to 78° (158° to 172° Fahr.) it took place, but more feeble. Milk warmed above 176° Fahr. (80° C.) remained uncolored when guaiac solution was added, either to the warm milk or after cooling. Milk once cooked did not show it, neither did condensed milk.

The reaction with tincture of guaiac is so delicate that one drop of milk added to a trace of the tincture on a watch glass, or a drop of milk on filter paper, turned blue when rubbed with a glass rod dipped in guaiac tincture. Sour milk also gives this reaction, but the addition of mineral acids and caustic alkalies destroys it.

According to some further experiments which he made



SECTION OF ENGINE CYLINDER.

this reaction must be due to ozone in fresh milk. It must also be mentioned that emulsions of olive, castor, linseed, and poppy seed oil, made according to the pharmacopœia, also blue the tincture of guaiac.

That this reaction agreed with that of other emulsive liquids caused the experimenter to examine whether milk and blood did not possess a common reaction. In fact, fresh milk, as well as boiled, acts as a carrier of ozone just like blood corpuscles, etc. If old oil of turpentine is added to a mixture of iodide of potassium starch and milk, a blue zone is formed at once where the layers are in contact, and rapidly spreads. Milk that has been boiled a long time does not give the reaction for several minutes, and at this length of time a mixture of turpentine and iodide of potassium starch frequently turns blue without any ozone carrier. Milk from which the albuminoid bodies have been removed no longer give the reaction.

If caustic potash and a trace of sulphate of copper solution is added to fresh milk, from which the casein has been removed by acetic acid, the violet color characteristic of peptones no longer appears. When the milk has been standing ten to twenty hours the continual increase of the peptones is indicated by the violet color growing all the time more and more intense.

COPPER IN BREAD.—The author concludes that wheat normally contains copper to the extent of 8 to 10 parts per million. He has experimented with grain, the seed of which had not been "pickled" with sulphate of copper (as is often done to prevent smut), and has satisfied himself that the copper was not due to any impurity in his reagents, or to the gas pipes and burners.—*Jules Van Dens Berghe.*

A NEW STEAM ENGINE.

We give engravings of several forms of an engine that marks a new departure in steam engineering. These engines are new in form, and embody features in their internal construction which distinguish them from all others. The principal novelty is in the valves and valve motion; the valves being located inside the cylinder, and the valve motion being such as to insure a quick opening and closing of the valve at the most favorable time. The ports communicate with the interior of the cylinder near opposite ends, and the exhaust and induction ports are, in the present case, placed diagonally opposite each other. In the future, however, it is designed in the larger sizes of engine to place two supply and one exhaust port at each end of the cylinder and on opposite sides of the valves, so as to insure a perfect equilibrium of pressure, and so to relieve the valves from friction.

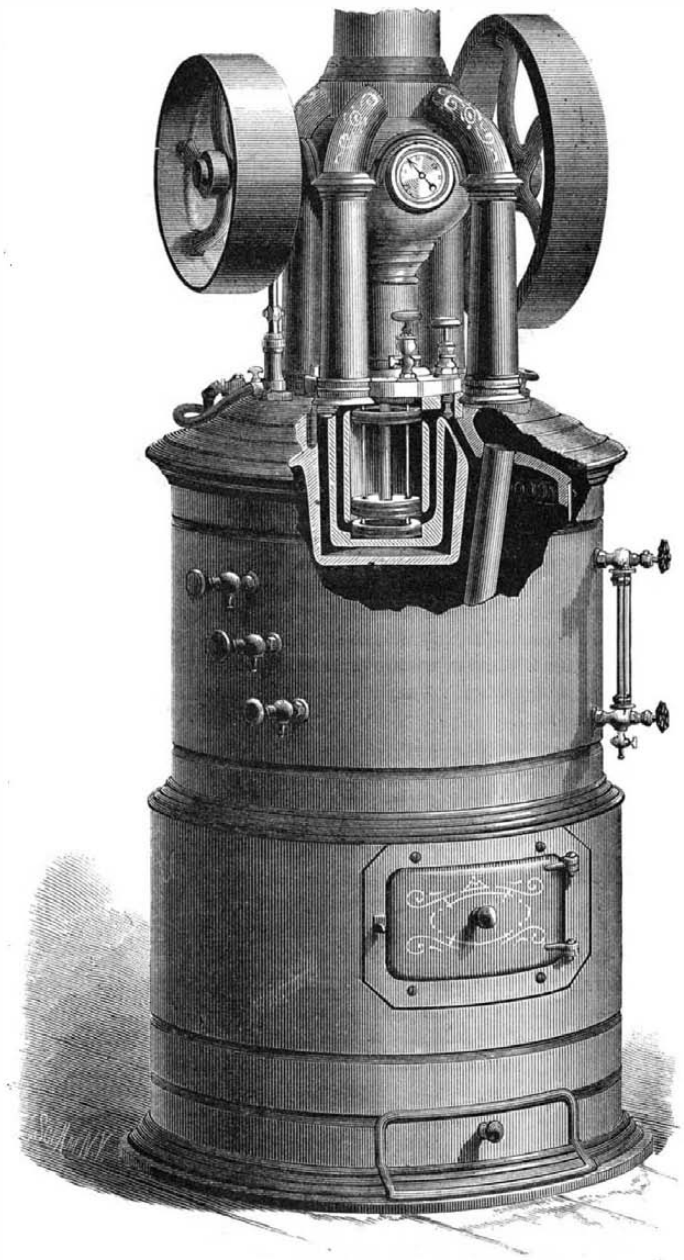
The valves consist of two rings, one placed at each end of the cylinder in an annular cavity between the inwardly projecting heads of the cylinder and the inner surface of the cylinder. The two valves are connected together by rods, which project through the top cover of the cylinder, and are connected with a rocking lever having forked arms, which straddle the engine shaft and carry rollers engaged by a cam on the main shaft, which moves the valves one way and the other.

The steam, at boiler pressure, is admitted by the valves directly into the cylinder without the loss due to steam contained in the ports and steam passages of engines as usually constructed. This is an important advantage, especially in quick running engines, since every half revolution of an ordinary engine is accompanied by the loss of a quantity of steam contained in the steam passages, and this loss, happening perhaps hundreds of times each minute, amounts, in the course of the day, to a considerable percentage of the steam used.

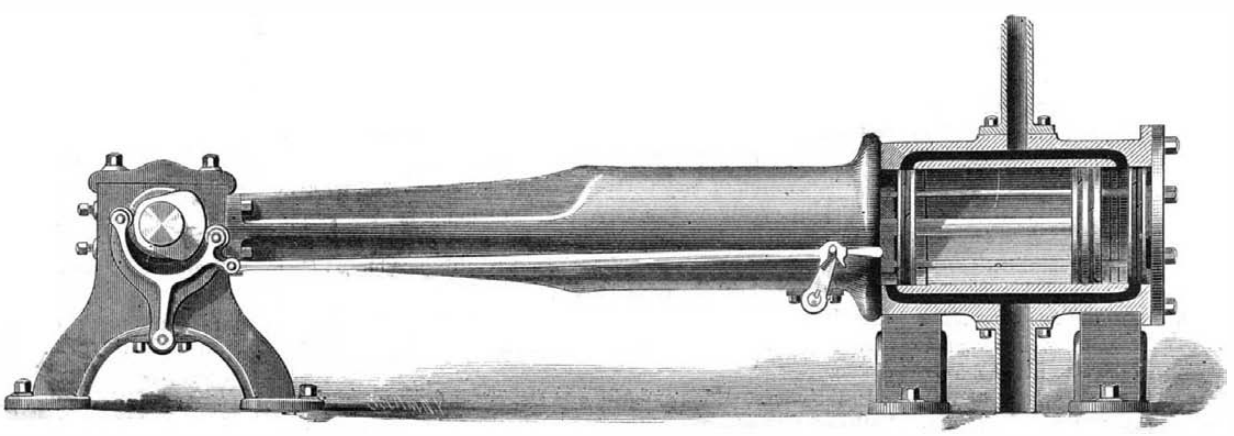
The ring valves are so related to the supply and exhaust ports that when the exhaust is open the supply will be closed, and *vice versa.*

In the engine shown in Fig. 1 the cylinder is seated on the top of the boiler and projects downward into a recess in the boiler top. By this means it is always kept warm, so that condensation is avoided. The screws and bolts are never brought into contact with steam or water; as a consequence all of the bolts may be readily removed when required.

The crank and valve gear of the engine are in a hollow globe having in opposite sides the bearings for the main shaft, and having cast together with its upper half, four flues communicating with the smoke chamber below and uniting at the top in a common flue, with which is connected the smoke pipe. The exhaust pipe of the engine extends upward through one of these flues, and discharges into the smoke pipe above, disposing of the exhaust steam and at the same time affording an efficient means of increasing the draught. The boiler of this engine has a number of flues leading directly to the smoke box, and several short flues leading from the fire box laterally to the jacket surrounding the boiler and communicating with the smoke box.



HUNT, HALSEY & BUDINGTON'S STEAM ENGINE.



HORIZONTAL ENGINE.

In the horizontal engine, shown in Fig. 3, the same general plan is followed, and in the locomotive engine, shown in Fig. 5, the construction of the cylinders and valves is substantially the same.

In the locomotive it is essential to provide a reversing gear; this consists

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in this case of a spiral cam on the driving axle which is capable of rotating the valve actuating cam through a half revolution when moved longitudinally on the axle.

The advantages claimed for this engine are great simplicity in construction, an increased economy in the use of steam, and a consequent saving in fuel, and important saving in the cost of manufacture.

This improved engine is covered by several patents owned by Messrs. Hunt, Halsey & Budington. Further particulars may be obtained by addressing Mr. Thos. G. Budington, 542 Washington avenue, Brooklyn, N. Y.

CHRONOGRAPH FOR ENGINEERING PURPOSES.

BY W. R. ECKART, C. E.

In the chronograph illustrated the tracers, both for recording seconds as well as the velocity curve of the engine, are made of flat strips of spring steel, the axis of each being pivoted at the end on adjustable screw centers to prevent lost motion. By means of a small steel wire and weight extending to the opposite side, the tracers can be made to bear as lightly as desirable on the paper, and when properly adjusted the pressure is only sufficient to remove the lampblack with which the paper is coated without touching the paper, thereby leaving a fine white line on the dark background with the least possible interruption of motion. The whole is permanently set by dipping the face in shellac.

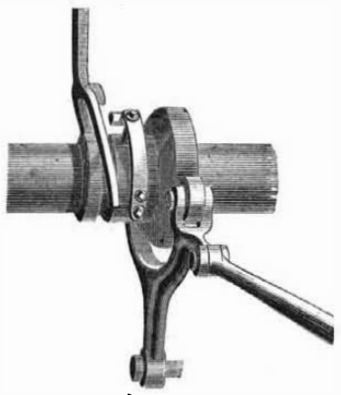
Instead of using a pendulum for producing (through an electro-magnet) the marks spacing seconds on the paper, some other method that would admit of compactness and portability was found necessary, as the chronograph was to be used not only on the surface where the pumping engines were situated, but had to be adapted to underground use.

After numerous experiments, the use of a chronoscope (or timer), such as is to be had for timing horse races, was made to give satisfactory results. (See Fig. 1, front page). A stand or base plate upon which the timer was placed had a brass stanchion suspending a fine platinum wire directly over the second hand; this wire, when at rest, bore on a piece of platinum inserted in a rubber insulator projecting from the stanchion, each of these wires being connected through the electro-magnet on the chronograph to a two-cell battery. A circuit was always formed, except when the hand of the timer, revolving once every second, swings the suspended wire free from its metal bearing at the apex of the triangular notch cut in the rubber guide piece; as contact was broken every revolution of the second hand, the armature of the electro-magnet recorded the same by a side movement of the steel tracer resting on the prepared paper of the drum. The suspending wire was made adjustable to suit the second hand, and the instrument was covered with a glass case.

Mr. Briggs states in a paper read before the Franklin Institute that Prof. Hilgard used a chronoscope for the Navy Ordnance Department, in which the second marks were 30 inches apart. I have found no trouble in speeding the revolving drum of 6" diameter, until the second marks were 20 inches apart, but for practical use, a length of three to ten inches (depending somewhat on the engine speed), was all that was desired, and by use of a standard steel scale with the inch divided into hundredths, changes of motion taking place in the one one-thousandth part of a second were easily read and recorded without trouble, and the crossing of lines due to the too frequent revolution of the recording drum during one stroke of the engine was avoided. The use of the small electro-magnet, on the tracer carriage, to raise for an instant the tracing pointer off of the drum at any desired point, was found necessary in determining the effects of elasticity in the interruption and variation of motion, where a *long* line of pump rods was used, and was also found useful in fixing, positively, the exact point of closing or opening of the steam valves of the engine independent of all reference to the indicator cards taken.

Two drawings giving different views of the chronograph as constructed and used, are attached to this article, exhibiting details of construction to complete what otherwise might be considered a defective description of the instrument.

The instrument has been successfully applied to several of the different types of large pumping engines found on the Comstock Lode, such as direct-acting flywheel engines, geared pumping engines, and the "Davy engines;" it has also been used to determine the motion and relative motion of pump rods, and pumps some 2,500 feet below the surface engine driving same, and at intermediate points. The results are exceedingly interesting and instructive, and as numerous indicator cards were taken from the engines and pumps simultaneously with the motion diagrams, nearly all conditions of motion and power, during the time under consideration, were definitely determined, and may hereafter form the subject of other papers when time will permit.



THE VALVE OPERATING MECHANISM.

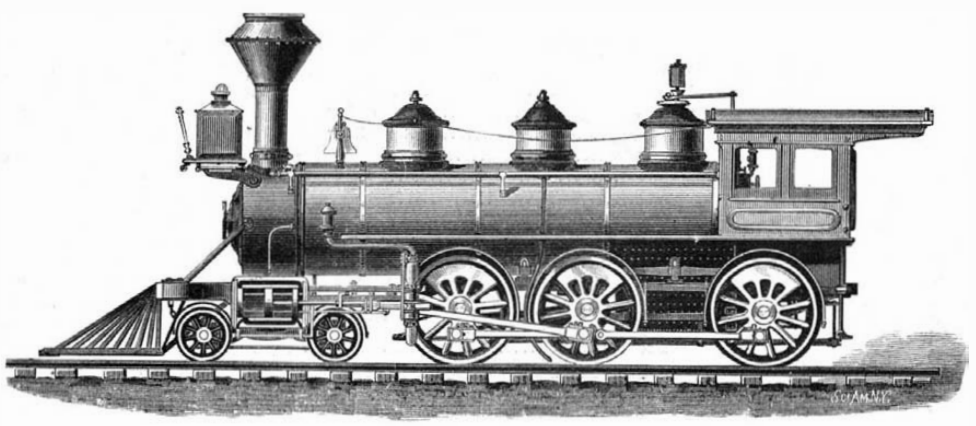
Some very important results of the elasticity of long pump rods are clearly set forth in one case: A rod at a point 1,800 feet below the surface showed a positive pause, while the engine driving it was nearly at its point of maximum motion, and pumps attached to the rods may have and do have strokes in excess of or deficient to the *stroke of engine driving same*, and to an *important extent*. Hence, I think, it can be definitely stated that any consideration of motion of pumps, or discharge capacity of same, driven by a long line of pump rods based upon the motion or stroke of a surface engine alone, will in no way be even approximate, unless the elasticity and effects of counter-balancing by balance bobs on that elasticity is also considered.

The effects of different degrees of compression upon the engines and motion of the pump rods in passing the centers have been considered, and the diagrams clearly show the importance of considering it in connection with the strength of the rods and balance bobs.

The latest use of the instrument in conjunction with an engine test has been to determine, if possible, the rate of condensation of steam per second, in the steam cylinders of a pumping engine, where the change of motion due to each fractional part of the stroke was determined. Also, a ten hour experiment trial, to show the economy of compression as compared with a ten-hour trial of the same engine on the succeeding day where no compression was used (otherwise all conditions being similar), has been made, when changes of velocity of piston were determined by the chronograph.

While it is well known that a Committee of the British Association applied a chronograph of Morin's type in 1843–4, to the determination of the velocity of piston for a Cornish Pump Engine, I believe there was no application of the instrument to the rods below ground, and, from published records at my command, I am led to believe that this is the first application of a chronograph of sensitive construction ever made to pit work, and the other purposes so briefly mentioned.

DESCRIPTION OF DRAWINGS. — C C, cast iron base plate, covered with sheet brass, upon which the mechanism is secured. B, metal frame containing gearing for driving drum, A, and escapement wheel, *b;* motion communicated by means of adjustable weights, D. A A, light brass drum, accurately balanced, revolving on friction rollers, 8, 8, at both ends. *f f*, parallel guide bars upon which the tracing point, h_0, and its carriage travel back and forth, receiving motion in one direction from the engine or other moving parts, through the cord, P, passing between the bars, *f*, and attached to the tracing carriage—the return motion is derived from a coiled spring in the spring drum, C. *e e*, small electro-magnets on tracing carriage for raising the tracing point, h_0, off of the paper and replacing it at any desired point to be especially observed. *d*, electro-magnets on separate carriage, *k k*, adjustable on parallel bars, *f*, operating the steel tracing point, *g*, attached to the armature of *d*, for the purpose of recording seconds on the margin of the paper or at other parts of same as required. *i*, chronoscope or watch supported on frame, X, the second hand of which swings the light platinum wire, J, breaking contact with the insulated wire, *k*, thereby breaking circuit with *d*, and recording seconds through the tracing point, *g*, on the paper. *q*, adjusting screw for the wire, J. *a*, steel spring of escapement. This spring is securely clamped in Y, its flexibility being controlled to a certain extent by means of the thumbscrews, *o* and *p*.



HUNT, HALSEY & BUDINGTON'S LOCOMOTIVE.

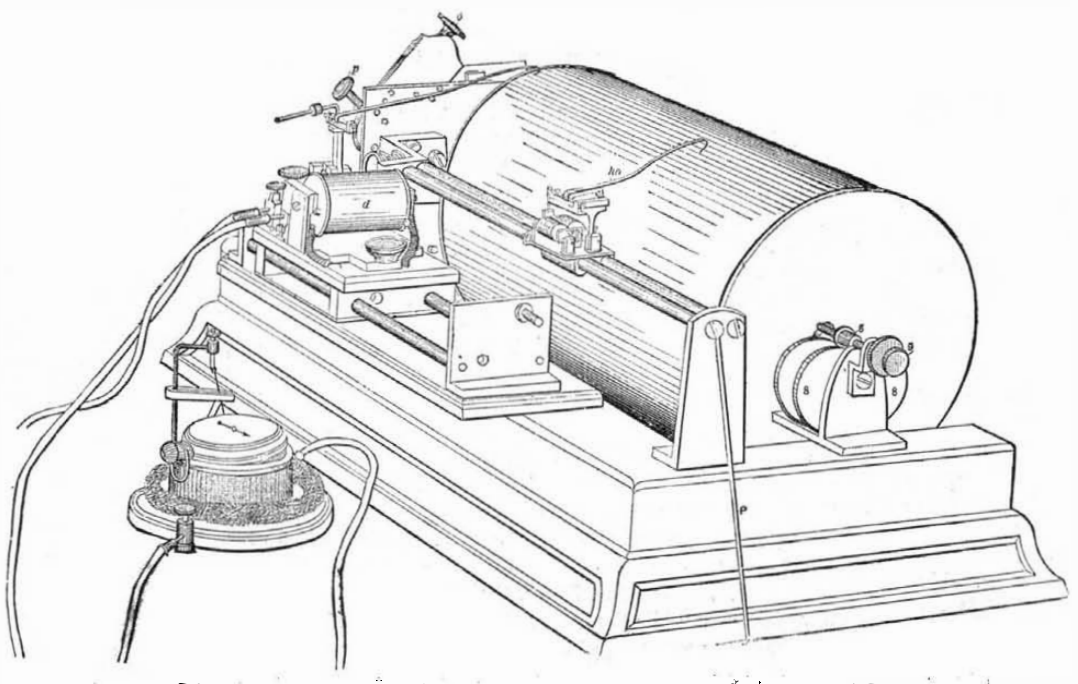


Fig. 2.—CHRONOGRAPH FOR ENGINEERING PURPOSES.

De Lesseps's New Project.

The French Cabinet Council has approved the scheme of M. de Lesseps for cutting a canal through the neck of land dividing the Gulf of Gabes from the salt marshes and low lying parts of the Desert of Sahara to the south of Tunis. It is expected that the sea will in virtue of this cutting once more fill up a considerable portion of the Sahara. The political advantage to be obtained by the scheme if it succeeds will be the insulation of Tunis and Algeria by creating a water barrier between them and Tripoli. The cost of the canal, it is estimated, will be 65,000,000f.

The Denver Mining Exhibition.

The National Mining and Industrial Exhibition to be held in Denver, Colorado, during the months of August, September, and October next, is intended to do for mining and related industries what the cotton fair at Atlanta, last summer, did for the industries there represented. The intention is to exhibit specimens of all the mineral products of this country, and especially the royal minerals, gold and silver, in connection with the machinery used in extracting and milling the ores, in such a manner that visitors may secure at a glance an idea of the vast mineral resources of the continent.

It is proposed to collect ores and minerals from every mine in the United States in such quantities that the exhibits will represent the average character of the mines from which they are taken. Accompanying the ores are to be charts of the mines, with detailed information of the assay value of the ores, the yields, process of milling, and the geological formation of the ground from which the ore is taken. The exhibits will be classified in States and districts, and each district will have its representative machinery on exhibition, showing the methods of working best adapted to different kinds of ore.

For the purpose of carrying this scheme into effect a company has been formed under the laws of Colorado, with a capital of $200,000, and of this amount $100,000 has been subscribed in the city of Denver alone. The company has purchased 40 acres of land in Denver, and a contract has already been made for the construction of a permanent exhibition building. This structure is to be 500 feet long and 316 feet wide, with large galleries and spacious windows, designed after the National Museum at Washington. It is to be constructed of stone, brick, iron, and glass, and the estimated cost is $135,000. An illustration of the proposed building was given in the SUPPLEMENT last week. The exhibition fund of $200,000 is now being raised.

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A Compensating Gas-Pressure Regulator.

M. Ville describes in the *Comptes Rendus* a special form of gas governor invented by himself in consequence of a need arising in the course of a series of experiments. He had in use a chamber in which gas was compressed, but wherein the pressure was liable to diminish by the effect of certain reactions going on inside. It was necessary to provide an arrangement whereby this internal pressure might be maintained constant, by admitting gas automatically from a reservoir at a higher pressure, whenever the pressure in the chamber varied even by a very small amount. For this purpose there was fixed to the chamber a mercury gauge of special form, not illustrated in the communication, but described as containing in one arm gas at a determined pressure, constant for a complete experiment, and communicating with the chamber by the other branch. If a diminution of pressure occurred in the chamber the mercury rose in the tube of the gauge, and came in contact with a needle of nickel-plated steel, isolated in the axis of the tube. By this means a circuit was completed in connection with an electro-magnet. The magnet attracted a lever of soft iron, to which was fixed a valve communicating with the high-pressure reservoir, which being opened, a quantity of gas sufficient to compensate for the reduction of pressure passed into the chamber. The desired pressure being reestablished, the electrical communication was broken by the fall of mercury in the gauge, and the reservoir was again shut. M. Ville's apparatus was competent to resist pressures equal to 15 atmospheres, and the magnet was strong enough to control a difference of pressure of two atmospheres on the valve. It was also extremely delicate, the needle being adjusted to one-fourth of a millimeter from the surface of the mercury in the gauge. Consequently a loss of pressure amounting to only this infinitesimal quantity was instantly compensated.

The Caroline Archipelago.

The Caroline Islands have recently been visited by the British war steamer Emerald. Her commander, Captain Maxwell, reports his arrival at Strong Island on June 25, 1881. He describes it as mountainous with lofty peaks, some 2,000 feet above sea-level, clothed with verdure to the summits; bread-fruit, bananas, etc., grow in abundance, but cocoa-nuts are far less plentiful than in the low coral islands, and, owing to the bountiful supply of water, they are not much needed. The ancient walls and fortifications on the small island of Lélé, where the king lives, are very extraordinary. The walls are some twenty feet high, having been in former times probably as high everywhere, and twelve feet thick, and are built of enormous basaltic rocks which must have been brought from a distance, and have cost much labor and ingenuity to raise them to their present position. The natives of Strong Island are described as a most gentle, amiable, and intelligent race; they are lighter in complexion than the Marshall islanders. Captain Maxwell afterwards visited Ponafi, or Ascension Island, in the Simavina group, the population of which is stated to be 5,000. This island is divided into several districts, each of which has its own chief. The natives are particularly pleasant and good-looking; Captain Maxwell thinks they have more refined features than any he has seen, but they are not so well dressed or advanced as the inhabitants of Strong Island—the grass petticoat, indeed, seemed to be the principal article of clothing. The island is about fourteen miles square and very beautiful, with lofty peaks from 2,000 feet to nearly 3,000 feet high, which are wooded to their summits, and is surrounded by coral reefs with pretty detached islets; all sorts of fruits and vegetables grow there in abundance. The ruins of residences of former chiefs are numerous and consist of inclosures within inclosures, with walls in some places thirty feet high and upwards of twelve feet thick, built of great basaltic prisms (many of them twelve feet by two feet six inches), laid regularly tier upon tier; each tier being at right angles to the one below, and the interstices filled in with coral and rubble.*

Phosphorescent Rock.

AT a recent meeting of the San Francisco Microscopical Society, Mr. H. G. Hanks, State Mineralogist, read the following paper:

Some time since, D. B. Huntley, of the Geological Corps of the Tenth Census of the United States, brought to the State Mining Bureau a mineral, with the statement that it had shown certain peculiarities which led the miners to call it by the rather startling name of "Hell-fire rock."

The property known to mineralogists as phosphorescence is not confined to one mineral species, nor is it very uncommon. But in this specimen it is so strongly marked that there is some excuse for the refusal on the part of some of the miners to work in the mine. When striking their picks into this formation, flashes of light were seen, which they regarded with superstitious alarm.

The locality in detail is Shenandoah mine, Snake Creek district, Wasatch county, Utah.

A chemical examination shows this mineral to be an impure dolomite. It is interesting, not only from its remarkable phosphorescence when rubbed with any hard substance in the dark, but from its beautiful crystalline appearance under the microscope, and the ease with which it can be reduced to a crystalline powder, even by crushing between the fingers.

In "Cleveland's Mineralogy" we find it stated that some varieties of dolomite are phosphorescent in the dark, either by friction or when thrown on a shovel which has been allowed to cool just below the point of redness.

The lights being turned down, Mr. Hanks produced the phosphorescence beautifully by scratching the specimen with a knife blade. It was of a bright reddish-yellow or orange color, and it was clearly seen how a miner could be agitated by striking such infernal material in his subterranean walks.

Details of Cost of One Standard Passenger Locomotive Truck—Chicago and Alton Railroad.

1 Truck saddle	1,175 lb.	$23 50
8 Pedestals	328 "	6.56
4 Truck boxes	512 "	10.24
4 Truck box cellars	72 "	1.44
4 Bottom spring pockets	100 "	2.00
2 Top spring pockets	70 "	1.40
4 Oil cups	7 "	14
2 Side bearings	50 "	1.00
4 Axle collars	80 "	1.60
4 30-inch wheels	1,926 "	38.52
2 Steel axles		48.76
1 Swing beam		8.10
2 Swing beam hangers	48 "	2.16
2 Swing beam hanger pins	6 "	27
1 Center pin	228 "	4.56
4 Brasses	110 "	22.00
2 Frames	380 "	17.10
2 Bottom braces	154 "	6.93
4 Equalizers	400 "	18.00
2 Check chains	16 "	72
1 Center pin bolt and key	13 "	58
8 Wheel cover braces	48 "	1.60
4 Springs		32.68
34 bolts	34 "	1.53
4 1-inch bolts	6 "	27
4 ¾-inch bolts 12½ inches long	6 "	27
4 ¾ Axle collar bolts	3 "	13
2 Eye bolts	4 "	18
4 Cellarpins and keys	6 "	27
4 Wheel covers	52 "	1.82
4 Pieces gas pipe		11
44 ⅞-inch nuts		65
12 ¾-inch nuts		13
4 1-inch nuts		11
2 Pounds woolen waste		24
1½ Gallon tallow		60
Total cost of material		$256.17
Blacksmith and machinists' labor		75.00
Total cost of truck		$331.17

Carbon under Pressure.

Some interesting experiments calculated to throw light on the action of the carbon rheostat, relay, and microphone transmitter, have just been made by Prof. S. P. Thompson, of University College, Bristol. With rods of Carré's electric lamp carbon subjected to pressure, and connected in a Wheatstone balance, so that their resistance could be measured either when the contacts with the battery current were of soldered copper or simply touching, he finds that there is no diminution of the internal resistance of the carbon under pressure with the soldered contacts, but a considerable resistance with the touching contacts. It follows that the observed diminution of carbon resistance under pressure is really due to the pressure making the contact between the carbon and the electrodes closer. In short, it is the effect discovered by Professor Hughes, and first explained by him to the Royal Society. Carbon is also said to diminish in resistance with a rise of temperature, but it would be well to test this assertion in the light of Professor Thompson's experiments. If it does, it would, as Professor Ayrton has suggested, seem to be a compound substance, since the elementary metals increase resistance with a rise of temperature.

Effect of Sunlight upon the Draught of Chimneys.

BY PROF. KOHLRAUSCH.

There has been a popular belief that the sun's rays had some influence upon the draught of chimneys, and when complaints were made that a stove would not draw the workman would blame the sunshine. Since Crookes' discovery of the mechanical action of light this supposition no longer seemed so utterly impossible as before, and the author considered it worth his while to make a careful experiment to determine its truth or falsity. The force of the sunlight is of course very slight in the case of the radiometer; but then the same may be said of a chimney, especially when a fire is first started, the counter pressure of the hundred-thousandth of an atmosphere might be critical.

The first thing requisite was a sufficiently delicate apparatus. A thin elastic piece of copper foil, one-twentieth millimeter thick, was bent into waves or corrugated, not concentrically like an aneroid barometer but in parallel straight lines, making waves 15 millimeters long. Such a piece of corrugated foil, 50 mm. (2 inches) high, and 150 mm. (6 inches) wide, was set in a frame, the edges on the short sides were fastened, while the longer ones above and below were free, so they could move one-half millimeter up and down in the frame. It does no harm to have this a little loose, as the open space is infinitesimal as compared with the section of a chimney or the grate of a stove.

A piece of cork is cemented to the foil on its shorter diameter, 20 mm. from the upper edge, in which is stuck a pin so that its head projects. A little mirror was placed vertically with this pin head resting against the back of it near the bottom. The mirror rotated on its horizontal axis, being held by two very fine steel pen points to diminish the friction to the minimum. When the pressure behind the foil increased it pushed this pin head forward against the mirror and turned it upward, and *vice versa*. The slightest vertical motion could be detected by its reflecting a beam of light as in a galvanometer.

To estimate the sensitiveness of this differential manometer the frame was set in the side of a vessel and a column of air 350 mm. (14 inches) long set in motion by illuminating gas This caused a motion of the mirror such that an image 3 meters (10 feet) distant moved about 40 mm Illuminating gas is about half as heavy as air, hence this column of gas equaled one of air only half as long (7 inches), so that the diminution of pressure behind the mirror was only one fifty-thousandth of an atmosphere. Since it is possible to read with the telescope one-half a millimeter accurately, the delicacy of the instrument reaches the one four-millionth of an atmosphere. This is accurate enough for chimneys, since it corresponds to a change of one tenth of a degree in a chimney 5 meters high.

In making the experiments the apparatus was set into the side of a wooden box, which had in the top and bottom a round opening, 80 mm. in diameter, that could be opened and closed. The one at the bottom being closed, the other was exposed alternately to sunshine and shadow. No effect was produced on the pressure in the box. The openings were then fitted with iron pipes, 14 inches long. If one opening was closed the slightest warming of the other pipe would cause an increase or decrease of pressure within, according as the bottom or top was warmed. Yet the sun's rays made no change in the pressure at all. By filling the box with smoke, which slowly emerged from the upper pipe, only negative results were obtained.

From all these and similar experiments it becomes evident that the idea of the sunshine injuring the draught must be consigned to the domain of baseless fables.

A Whitewash that will Stick and Wash.

We find in a German paper a formula for a wash which can be applied to lime walls and afterward become waterproof so as to bear washing. Resenschek, of Munich, mixes together the powder from 3 parts silicious rock (quartz), 3 parts broken marble and sandstone, also 2 parts of burned porcelain clay, with 2 parts freshly slaked lime, still warm. In this way a wash is made which forms a silicate if often wetted, and becomes after a time almost like stone. The four constituents mixed together give the ground color to which any pigment that can be used with lime is added. It is applied quite thickly to the wall or other surface, let dry one day, and the next day frequently covered with water, which makes it waterproof.

This wash can be cleansed with water without losing any of its color; on the contrary, each time it gets harder, so that it can even be brushed, while its porosity makes it look soft. The wash or calcimine can be used for ordinary purposes as well as far the finest painting. A so-called fresco surface can be prepared with it in the dry way.

Axle Telephone.

C. Resio, referring to an arrangement which he laid before the French Academy in 1880, announces that he has contrived a new apparatus which may be applied to any machine by a suitable modification of the transmitter, and by which a single observer, placed at any distance from the machine, may measure the torsion and the angular speed of the motor axle, and, in consequence, the work of the machine. The principle upon which the invention is based is thus announced: If in a circuit containing a battery and a current interruptor capable of giving a sound there are two identical coils, A, A′, arranged in tension, the one to the right and the other to the left, the induction currents excited in two other cells (induced), B and B′, equal in every respect and connected in tension in a circuit containing a telephone, destroy each other, and in consequence the telephone will be silent if they are equidistant from the inducing coils, A, A′, but it will emit a sound if the distances are unequal.

Ice Floes and Polar Bears in the Atlantic.

Incoming vessels continue to report unusual amounts of ice off Newfoundland. The British steamer Glamorgan, from Liverpool, April 15, arrived in Boston May 1, and reported that on April 25, in latitude 46° 20′, longitude 42° 30′, she passed an iceberg fully 500 feet high, on which were polar bears. About four o'clock on the morning of the 26th, while going eleven knots an hour, she ran into a field of pack ice and icebergs. Chief Officer May, who was on duty at the time, reversed the engines and soon got clear. A run of twenty miles was made to the southeast, when the ship was put on her course again. She steamed 160 miles on the southern edge of the icefield, and during that time passed fully one hundred large icebergs, on which were seen polar bears and a large number of seals. Several sailing vessels, names unknown, were sighted icebound, but no wreckage. The steamer was within 500 feet of the largest icebergs, giving a grand view.

Smallpox in Hayti.

An extract from a private letter of the late British Vice-Consul at Port-au-Prince, published in the *Times*, gives a terrible picture of the recent ravages of smallpox in the island of Hayti among a population of less than a million people. It appears that the disease carried off at least 5,000 persons within about three months of its prevalence, and it is calculated that not less than 20,000 persons have perished from it.

* Royal Geographical Society Proceedings, February, 1882.

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American Agriculture vs. English.

Mr. Fowler, M. P. for Cambridge, recently gave to a Chicago *Tribune* reporter his impressions of the agricultural resources of the West, where he has spent some time in making observations. "What has interested me most," said he, "is the matter of transportation to England, in connection with the cost of production there, and the question is whether we can continue much longer to compete with America in the raising of wheat, or even to raise it at all and make it pay. The natural protection to English production, by reason of the cost of carriage, must be—nay, is—rapidly diminishing, and I rather expect, if we were to have a good harvest in Europe and America at the same time, you would have prices such as we have never expected." "The American farmer is producing and transporting wheat and corn so cheaply, then, that his English brother cannot compete with him?" "It is a good deal as a gentleman expressed it to me the other day, when he said: 'A man out here in Iowa is competing with the English farmer just as if he lived in Yorkshire.' That may be a strong way of putting it, but you must observe the great advantages which the American farmer has over the farmer on the other side Iowa land, for instance, costs $10 an acre, while in England it costs £50, £70, or £80 an acre, so that the Englishman is terribly handicapped at the start, for he has to pay interest on £50 to £70, while the Iowa man pays interest only on £2. Then, in addition to all that, the Iowa man has a better soil and a better climate. In short, with these advantages in favor of the American farmer, with the cost of transportation minimized as it is, so that our natural protection from that cause is rapidly diminishing, I have great doubts whether the cultivation of wheat will pay in England at all. I speak not so much of the present as of the future, for our crop this year has been a good one, while yours seems to have been just the other way. Your deficiency this year, as I have seen it stated, is 80,000,000 bushels—nearly as large as England's entire production in an ordinary season. But here is your vast expanse of territory developing every year. Then, again, you virtually raise wheat in this country by machinery. The extent of your wheat raising territory is simply astounding, but your population, while large in the aggregate, is spread over these vast expanses, and your real market is elsewhere—across the water, over in England, where we find a contrary state of affairs—a comparatively small wheat raising area, with millions of people to be fed. And I don't begrudge you your good fortune in the least. Your prosperity is ours, for, unless our people be cheaply fed, they cannot afford to work for reasonable wages, and unless we can manufacture at reasonable cost, we can no longer hope to supply the world with our manufactured products."

IMPROVED CAR COUPLING.

The engraving shows an improved coupling for the class of railroad cars employing the ordinary link. The design of the coupler is to furnish a means of coupling and detaching cars without the necessity of going between them.

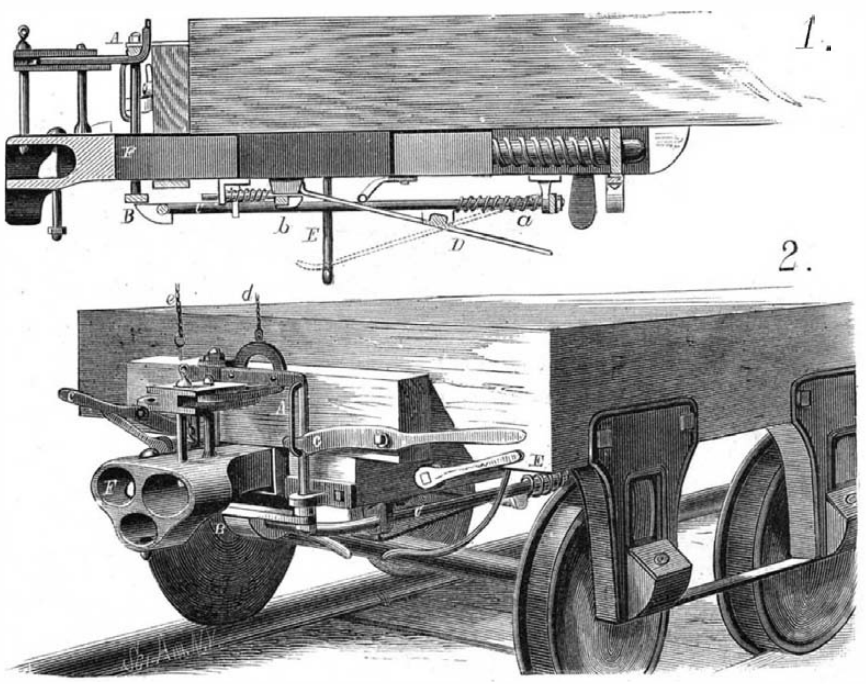
In this device the coupling pin is held in an elevated position, ready for coupling the cars, by an ingenious device, which will be readily understood by reference to the engraving, in which Fig. 1 is a sectional view, and Fig. 2 a perspective view.

A vertically sliding frame, A, is supported by a nib, B, on the forward end of the frame, C. This frame is thrown forward by the springs, *a*, and carries a pawl, D. Upon opposite sides of the drawhead there are levers, E, for pushing the pawl, D, above the spring catch, *b*, and behind a lug on the drawhead, F. The vertical frame, A, may be raised by either one of the levers, *c*, or, from the top of the car, by the chain, *d*, and one of the levers, E, may be operated by the chain, *e*, from the top of the car, if desired.

The operation of the coupler is as follows: A link being in one of the openings of the drawhead of the approaching car, and entering one of the three openings in the drawhead, E, the contact of the two heads pushes the drawhead, E, back, carrying the frame, C, with it. The nib, B, being drawn from beneath the frame, A, allows the latter to drop, while the pin supported by it drops through the link.

To uncouple the car one of the levers, *c*, is pressed down, thereby elevating the frame, A, and withdrawing the pin from the link. The frame is retained in an elevated position by the nib, B.

All that is now required to put the coupling in condition for operation is to raise the pawl, D, by means of the levers, *c*. This improved coupler is the invention of Mr. F. W. Brooks, of Oak Grove, Dodge county, Wis.



BROOKS' CAR COUPLING.

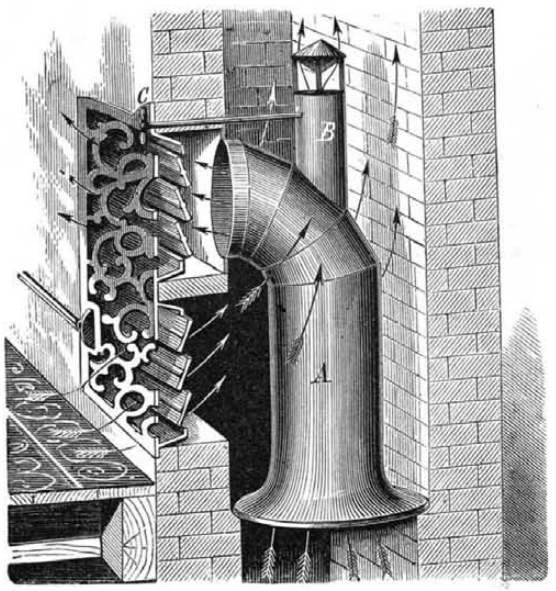
It is one of the most striking illustrations of the power of machinery that cotton can be brought from the far interior of India, on the backs of bullocks, to the sea, shipped around the Cape of Good Hope to England, manufactured, shipped back by the same route, paying repeated commissions and profits, and undersell the native manufacturer on the spot where the raw product is grown, and where labor is considered well paid at fifteen cents a day.—*Senator Bayard.*

BARKER'S HEATING AND VENTILATING APPARATUS.

The recent disclosures made concerning the very defective heating and ventilating arrangements in the public schools and court rooms of this city have, to a considerable degree, aroused the attention of the public, not only in this but in other localities, to the existing necessity of improved and simple means for securing constant supplies of pure fresh warm air in crowded apartments.

We herewith present a device which the inventor thinks is of timely importance, and hence worthy of the careful examination of health boards, architects, builders, and property owners generally.

A supplementary flue, A, flared at its lower end, surmounts the flue leading from the furnace.



BARKER'S HEATING AND VENTILATING APPARATUS.

Its upper extremity is curved to terminate in the upper half of a register, through which the hot air is delivered into the room. It will be observed that the register, though having a single grating of the usual size, is divided by a horizontal partition, and each portion is provided with a separate set of slats, either of which may be opened or closed at will. While the hot air from the flue, A, pours into the room in an ascending current, as indicated by the arrows, the cold and heavy vitiated air, which sinks to the floor, makes its exit into the lower half of the register, entering the main flue in the space between the supplementary pipe and the brick work, and thence passing up the chimney. By this means a constant circulation of fresh air is maintained in the room, a candle or handkerchief held before the two portions of the combined register indicating clearly the direction of the ingress and egress currents. By a simple modification the device is adapted for floor registers.

The invention is covered by five patents of recent date.

For further information address the owner, S. M. Barker, Washington, D. C.

A Substitute for Earthenware.

P. Dodé in Paris manufactures tiles, pipes, architectural ornaments, pavements, mantels, etc., from a new material made as follows: Some difficultly fusible stuff like sand, or pulverized porcelain, is mixed with powdered glass and a little water. The mass is then made into balls or plates, and heated until the glass softens, when it is pressed into the desired shape and cooled. For the mixture 100 lb. of very finely pulverized glass is mixed with 500 lb. of sand, and some metallic oxide added to impart the desired color; it is very thoroughly incorporated with the aid of a little water to make it plastic. The slabs or balls formed from it are placed on plates of refractory clay, and run into a furnace provided with little trucks like the tempering furnaces of a glass house. When the glass is softened the balls are put into metallic moulds provided with a stamp or piston, which falls as often as the finished article is taken out and fresh material put in, which takes about five or six seconds. The quantity and quality of the glass employed is varied according to the fusibility of the other constituent employed in each case. If very finely pulverized porcelain is employed instead of sand, then the ware obtained will closely resemble porcelain. As the glass is only softened, not entirely melted, it will probably be found possible to combine several colors in a single object and to produce various other curious and novel effects. Nothing is said in regard, however, as to the possibility of decorating the articles before or after pressing, or as to the effect of etching and grinding.

LEAD POISONING IN FACTORIES.—Commenting on a recent fatal case of lead poisoning in an English factory, Dr. William Webb, of Werksworth, Derbyshire, tells the *Lancet* that twenty-five years ago poisoning by lead was of frequent occurrence at the lead smelting works in that part of Derbyshire, and that since that time it has seldom been heard of. He attributes this immunity from poisoning in men constantly exposed to the fumes of lead to the fact that they were advised to partake freely of fat bacon, butter, and other fatty substances, and to drink copiously of lemonade or dilute sulphuric acid in water. The hint was first obtained from Sir Thomas Watson's admirable lectures on the "Practice of Physic."

MISCELLANEOUS INVENTIONS.

Mr. Charles H. Gimingham, of Newcastle-upon-Tyne, County of Northumberland, England, has patented a method of cheaply and readily manufacturing incandescent lamps. and a novel method of mounting carbon filaments of electric lamps generally. The method of attaching carbon threads to a tubular holder consists in first dipping the thread ends in a paste formed of a carbonaceous compound and a platinum salt, and then slipping them into the tube, and then holding them in a Bunsen gas flame until the paste is carbonized and the platinum salt is reduced to metallic platinum.

An improvement in pantaloons has been patented by Mr. William Hyams, of New York city. The object of this invention is to make pants durable at the crotch and at the knees. The seat of the pants is made without a seam, and is thus made very strong and durable. It is connected directly with the fly by means of the tongue, so that in bending and stooping the strain will be altogether on the tongue, which is not apt to break off, as it is made integral with the seat—that is, cut out of one piece with the seat. The seams uniting the front and rear pieces at the crotch cannot be ripped or torn by the strain on the seat, as all this strain is taken up by the tongue. The pants are made with double thickness at the knees, and are very durable.

An improvement in bottle stoppers has been patented by Mr. John Q. Houts and Oscar Ericsson, of Sioux Falls, D. T. This invention is an improvement on the bottle stopper for which Letters Patent No. 234,035 were issued to John Q. Houts, November 2, 1880.

Mr. William C. Salmon, of Portland, Ore., has patented an improved mill for pulverizing ores, cements, bones, and other substances. The mill is constructed with a vessel having a central projection on its bottom, forming a ring chamber, a sectional ring die in the bottom of the ring chamber, and screen-covered openings in its sides for the escape of the pulp, and a ring-shaped pulverizer having radial dies upon its lower side, which work on the ring die. The driving mechanism connected with the pulverizer gives it a wabbling movement. Guide blocks attached to the central projection of the vessel insure the centering of the pulverizer.

An improved coiler for railway heads, carding machines, etc., has been patented by Mr. Roger Tatham, of Rochdale, County of Lancaster, England. This invention relates to that class of machines in which two cans are alternately presented to the carding machines to receive the sliver or other material as it is delivered therefrom, and when brought into proper position to receive such sliver are revolved. The invention consists in the construction of two trains of mechanism, one consisting of cog wheels and the other of cog, bevel, and worm wheels, worms, a tappet pin, and a stud, both trains actuated by the same driving shaft, whereby the cans attached to the coilers are simultaneously rotated and delivered.

Mr. Henry Hager, of Elizabeth, N. J., has patented an improved machine for drilling two holes simultaneously at variable distances from each other. The invention consists in a drilling machine constructed with a fixed drill shaft and with a circularly movable drill shaft.

THE London *Builder* attributes the marvelous durability of mortar in Italy to the fact that the lime remains in a pit covered with water for two years before it is used, whereas in England lime is slaked and used the same day. Most building specifications even require newly slaked lime.

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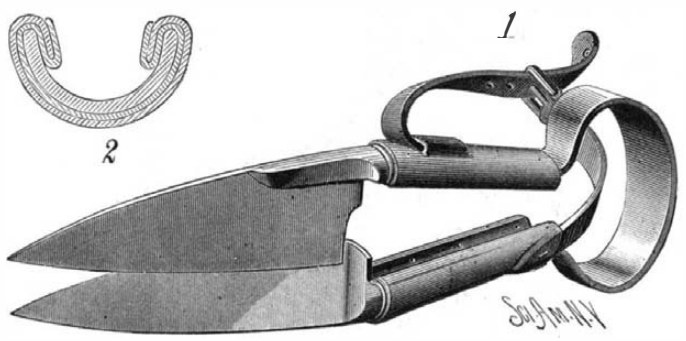
IMPROVED SHEEP SHEARS.

The engraving shows an improved sheep shears recently patented by Mr. Alfred P. Mann, of Kearney, Neb. The improvement consists of flexible padded casings, connected by a strap, and capable of being bent over the shanks of the shears. The strap is made adjustable so as to adapt it to hands of different sizes. This strap prevents the hand from slipping forward while crowding the shears into wool. It also prevents the shears from being kicked from the hand of the shearer.

The soft pad covering the handles prevents the hands from becoming blistered, and in a great measure prevents the tiring of the hand. The inventor says it enables a shearer to shear from ten to twenty more sheep per day than he can shear with the ordinary shears.



MANN'S SHEEP SHEARS.

IMPROVED FRUIT EVAPORATOR.

In properly evaporated fruit there is no loss of pleasant or valuable properties, but an actual increase of fruit sugar, from the fact that evaporation is essentially a ripening process, the development of sugar ranging from ten to twenty-five per cent in different fruits, as determined by chemical analysis. By the process of evaporation, properly conducted, in a few hours the juices are quickly maturated and the maximum development of sugar secured, and water pure and simple evaporated, the change being analogous to the transition of the grape to the sweeter raisin, or the acid green apple to ripeness, with corresponding delicacy. The cell structure remains unbroken, and the articles, when placed in the rejuvenating bath of fresh water, return to their original form, color, and consistency.

In evaporating cut fruits, such as apples, pears, and peaches, the correct method is to subject them to currents of dry heated air, so as to dry the cut surfaces quickly, preventing discoloration, forming an artificial skin or covering, and hermetically sealing the cells containing acid and starch, which yield glucose or fruit sugar. This principle is demonstrated in nature's laboratory, in the curing of the raisin, fig, and date, which are dried in their natural skins—a process not applicable to cut fruits—in a tropical climate, during the rainless season, by natural, dry, hot air, in the sun; though a crude and slow process, the development of glucose or grape sugar is almost perfect.

The annexed engraving shows a practical, economical, and inexpensive fruit drier made by the American Manufacturing Company. In this evaporator separate currents of dry, heated air, automatically created, pass underneath and diagonally through the trays and then off and over them, carrying the moisture out of the evaporator, without coming in contact with the trays of fruit previously entered, and already in an advanced stage of completion. The greatest heat is concentrated upon each tray or group when it first enters the machine, and each tray or group subsequently entered removes or shoves the previous one forward into a lower temperature. This operation is continued throughout, being rendered perfectly practicable by the inclined, divided evaporating trunk. No steaming, cooking, or retrograde process becomes possible.

We are informed that, so perfect is the active circulation of dry, hot air over, under, and through each line of trays, any tray taken from any portion of the trunk at any time, after being in the evaporator ten minutes, will be found to contain fruit that is perfectly dry on the outside, to sight or touch, although the process of complete evaporation may be but one-quarter or one-half finished.

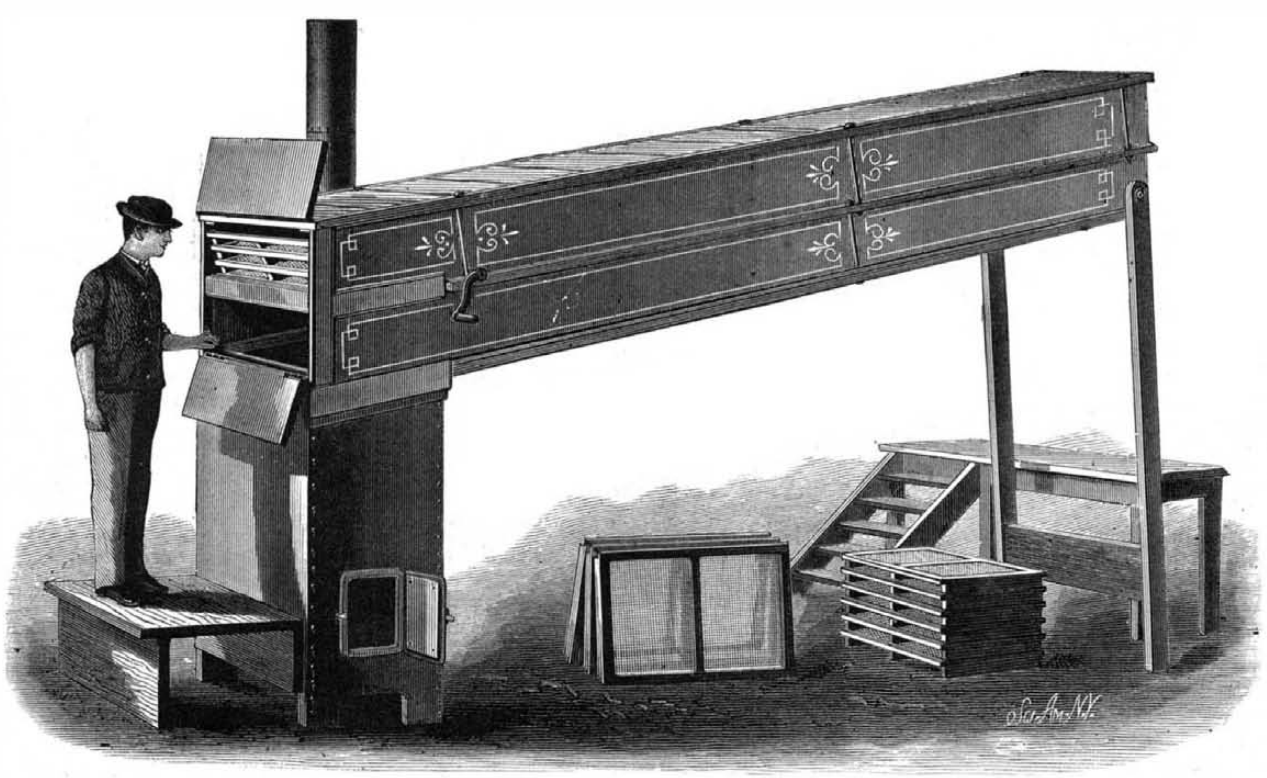
By this construction a maximum evaporating capacity per square foot of tray surface is secured, and the full benefit of fuel consumed is realized, and there is entire freedom from burning or scorching. A bright characteristic color in the product is secured, and the product is, in every way, perfect and capable of commanding the highest market price.

These evaporators are made in various sizes, adapted to home use or to the more extensive requirements of the fruit-evaporating establishment.

As the quality of evaporated fruit has been improved by the introduction of more perfect apparatus and methods, the market has increased and better prices are commanded.

The evaporation of fruits has become a profitable business even to those employing the more costly and extensive apparatus. The improved evaporator shown in the engraving has all of the advantages of the more complicated and costly apparatus with none of its disadvantages, besides being portable and perfectly adapted to its work.

For further information address the American Manufacturing Company, Waynesboro, Pa.



THE AMERICAN FRUIT EVAPORATOR.

Stanley in Africa.

The latest published letter from Stanley was written from the general camp of the expedition on the upper Congo, January 16, 1882. The explorer and now pioneer of civilization in Southwest Africa had quite recovered from the illness which came so near ending his work last year; and barring the heat, bad water, and the meagerness and monotony of his African diet, he would appear to have nothing to complain of. His party numbers 236, over 200 of whom are Zanzibaris; the rest are West Coast natives and a few whites. Fifty of the Zanzibaris were with him on the expedition across the continent. He describes them as a fine set of fellows, obedient, docile, brave, and hard working. "They will not steal because they are intelligent enough to perceive that this would ruin the peace which we have hitherto kept." Further on he says:

"As for the natives themselves, it would do your heart good to see the crowds that gaze at us while we are at work—the perfect confidence they have in us. In the midst of the best governed European capital nowhere could you see so many children in the same limited area as have been seen in my camp to-day. Not one grown person had a gun, spear, knife, or weapon of any kind within the camp. At the present time I have no cause of discontent with any living person. From the sea to this present camp our life has been peaceful and pleasant, so far as the natives are concerned. They have done much for me and I have done much for them. The first year we had some trouble with the whites, but they were not of my choosing. They were strangers to Africa, and most of them had never been out of their own country. Consequently, one slight fever damaged their African enthusiasm so much that they begged me to send them home. Neither the natives nor the Zanzibaris ever gave me so much trouble as these white men. The misery of spirit I endured in the first year culminated in that sickness. For months I have known neither trouble nor discontent, anguish of spirit, or bodily pain. Instead of looking back we are now looking forward, and this year will, I hope, see the labor accomplished which I had agreed to undertake. The worst of it is over, thank Heaven!"

This letter was written to the Paris correspondent of the Boston *Journal*, who remarks that Mr. Stanley maintains a certain reticence about the exact nature of his work in Africa, for reasons which most readers will readily understand. He is the agent of companies which have invested large amounts of capital in opening up sections of Africa, and who naturally desire to secure for themselves all the advantages which may accrue from the explorer's labors. In a few months we shall probably hear rather interesting and possibly somewhat startling news from the little camp on the Upper Congo.

New Process for Preserving Iron.

A new process for preserving iron consists in treating the casting with dilute hydrochloric acid, which dissolves a little of the metal and leaves a skin of homogeneous graphite holding well to the iron. The article is then washed in a receiver with hot or cold water, or cooked in steam, so as to remove completely the chloride of iron that has been formed. Finally the piece is allowed to dry in the emptied receiver, and a solution of caoutchouc, gutta-percha, or gum resin in essence of petroleum is injected, and the essence afterward evaporating leaves a hard and solid enamel on the surface of the ironwork. Another plan is to keep the chloride of iron on the metal instead of washing it off, and to plunge the piece into a bath of silicate and borate of soda. Thus is formed a silico-borate of iron very hard and brilliant, which fills the pores of the metal skin. As for the chlorine disengaged, it combines with the soda to form chloride of sodium, which remains in the pickle.

Is the Human Skull Becoming Thinner?

Mr. W. B. Cooper endeavors to show that it is. If, he says, we accept the tenets of evolutionists, a race adapted to certain circumstances will, if these circumstances be altered, become modified in a corresponding degree, and retrogression may result as well as improvement, and this modification may be confined to a certain part or organ. What forces, then, have exerted their influence on the casket of the brain? First, natural selection, in the case of those creatures that engaged in fierce combats, would tend to eliminate those individuals with frail craniums; and, as man comes within the category of belligerent creatures, when barbaric warfare and the dangers of the chase were common occurrences, natural selection would, of course, exercise a powerful influence in maintaining a standard of cranial strength. Then, too, in the presence of repeated violence, adaptation would undoubtedly provide a suitable armor for this delicate and important organ. In civilized man, however—at all events, in the higher grades of modern civilization—natural selection may be said to exert no influence in that direction; war is too infrequent and engages too small a portion of mankind, while the forces with which it deals are of a nature to alter the whole aspects of the case. And while adaptation undoubtedly operates upon other portions of the frame to maintain their rigidity, it is rarely that the skull is called upon to support any greater pressure than that exerted by the head gear. It is not to be overlooked that among semi-civilized people the head is often made to support considerable weights, and, except where rigid rules prevent intermarriage of classes, the joint action of adaptation and heredity disseminate the effects of this custom throughout the community. A blow that would shatter a European skull falls harmless on that of a negro. There probably never was a time in the history of the world when the skull was subjected to so little violence as since the introduction of modern methods of transportation; and, when we recall the fact that it was but a few centuries ago that the more advanced nations of the present day were barbaric, it is too soon to look for any great change. Yet it is not uncommon to hear of cases of the fracture of the skull which are ascribed to its unusual thinness. May not these be the results of the co-operation of the agencies referred to?

If the force of the position assumed by Mr. Cooper is accepted, the logical conclusion is that we are approaching a time when the human cranium will become much thinner—so delicate, in fact, that it will be easily fractured; we may then, he thinks, expect a revival of natural selection, and an increase of cases of death from violence to the head.

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The Heathen Chinee Sparrow.

Passer domesticus has its place in nature; possibly monarchical Europe and monarchical individuals in other places can overestimate their worth, but in America they are out of place, and their introduction was a grievous mistake. Its disposition is very far from being republican, and its treatment of some of our native birds, which are of much more value than themselves, is tyrannical and despotic. Quarrelsome with and pugnacious toward the swallows, martins, wrens, and bluebirds, they take by force the houses put up especially for their use. Thanks for the love of liberty, right and justice, the swallow, martin, wren, or bluebird having possession of the house can, and usually does succeed in keeping it against the attack of a single pair of sparrows, but often this pair, unsuccessful in their house-breaking attempt, go off and solicit the aid of their fellows, and return with a dozen or twenty of their kind, lay siege to the place, and by united effort take it, after the rightful occupants have made a desperate defense against enormous odds.

It may be only a coincidence—it is a fact, however—that, as the sparrows have increased in numbers, the purple martins, *Progne purpurea*, have decreased in this locality.

The sparrows are essentially graminivorous and frugivorous, and are not insectivorous in the legitimate use of the term. They are very destructive to garden and flower seeds, the small grain, and no species of fruit is free from their depredations. They are more dirty around the house than any of our native, social birds, dropping *en masse* their excrements about the door. I presume they have their good qualities. I cannot agree with Mr. Minot when he says of the purple grackles that he "would not hesitate to sign the death warrant of the whole race," but I would not hesitate to sign a warrant to banish the house sparrow from the United States to the place from which they came, and furnish a liberal supply of good food and clean water for the voyage.—*Elisha Slade, Somerset, Mass., in American Naturalist.*

Cymene from Turpentine.

Naudin has pointed out a reaction by which cymene can be prepared from turpentine with great facility. If two atoms of dry chlorine are absorbed by one molecule of turpentine cooled to —15°, there is no sensible evolution of hydrogen chloride, but the liquid becomes viscous and contains $C_{10}H_{16}Cl_2$. A slight elevation of temperature produces decomposition, and cymene and hydrogen chloride distill together. If to the mixture 4 per cent of phosphorus chloride be added, and the temperature be maintained at 25°, a regular evolution of HCl takes place until the conversion is complete. Washing with water, drying over calcium chloride, and rectification over sodium, gives pure cymene boiling at 175°, the yield being 75 per cent. The author has observed that at 100° traces of zinc dust violently decompose the body $C_{10}H_{16}Cl_2$.—*Bull. Soc. Ch.*

PERUKE-HORNED DOE.

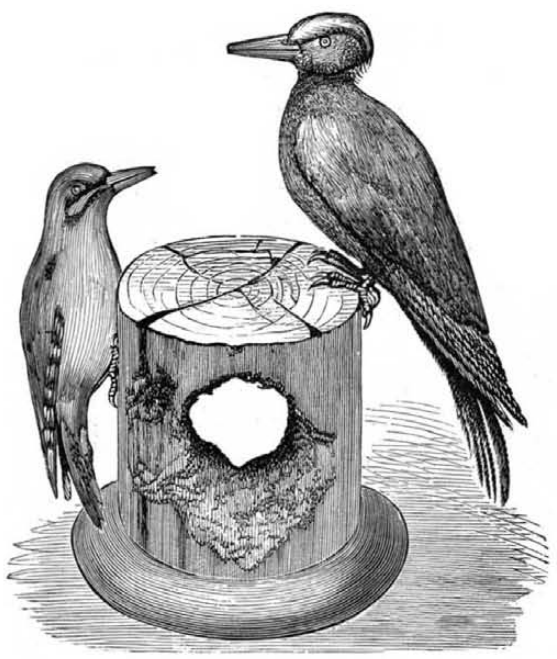
Our engraving represents the head and horns of a doe, which was killed the first of last December in the hunting grounds of Herr Hugo Pönsgen, in the district of Aix-la-Chapelle. It differs in no respect from the abnormal horn formations which make their appearance in emasculated bucks, and are represented in most collections under the name of perukes, bishop-caps, etc. The appearance of such horns in a female has, until now, been rarely observed, although in old does smaller stunted horn formations have sometimes made their appearance.

The head and neck of the doe was sent, the day after the hunt, to Düsseldorf, to the well-known taxidermist, Joseph Guntermann. The height of the longest horn was 19 centimeters. The head from the point of the nose to the rosette 15·2 centimeters. The skin on the neck was extremely thin and parchment like in quality, while in the bucks at this time of year the skin is of considerable strength and thickness.

According to the statement of Herr Pönsgen, this doe, with the exception of the horns, differed in no respect in form from the wild does. It was in good condition, its weight being 16 kilogrammes. There were no traces of an earlier wound, and the doe in its lifetime was never seen by hunters in this or adjoining districts.—*Illustrirte Zeitung.*

THE ELECTRIC TELEGRAPH AND THE WOODPECKERS.

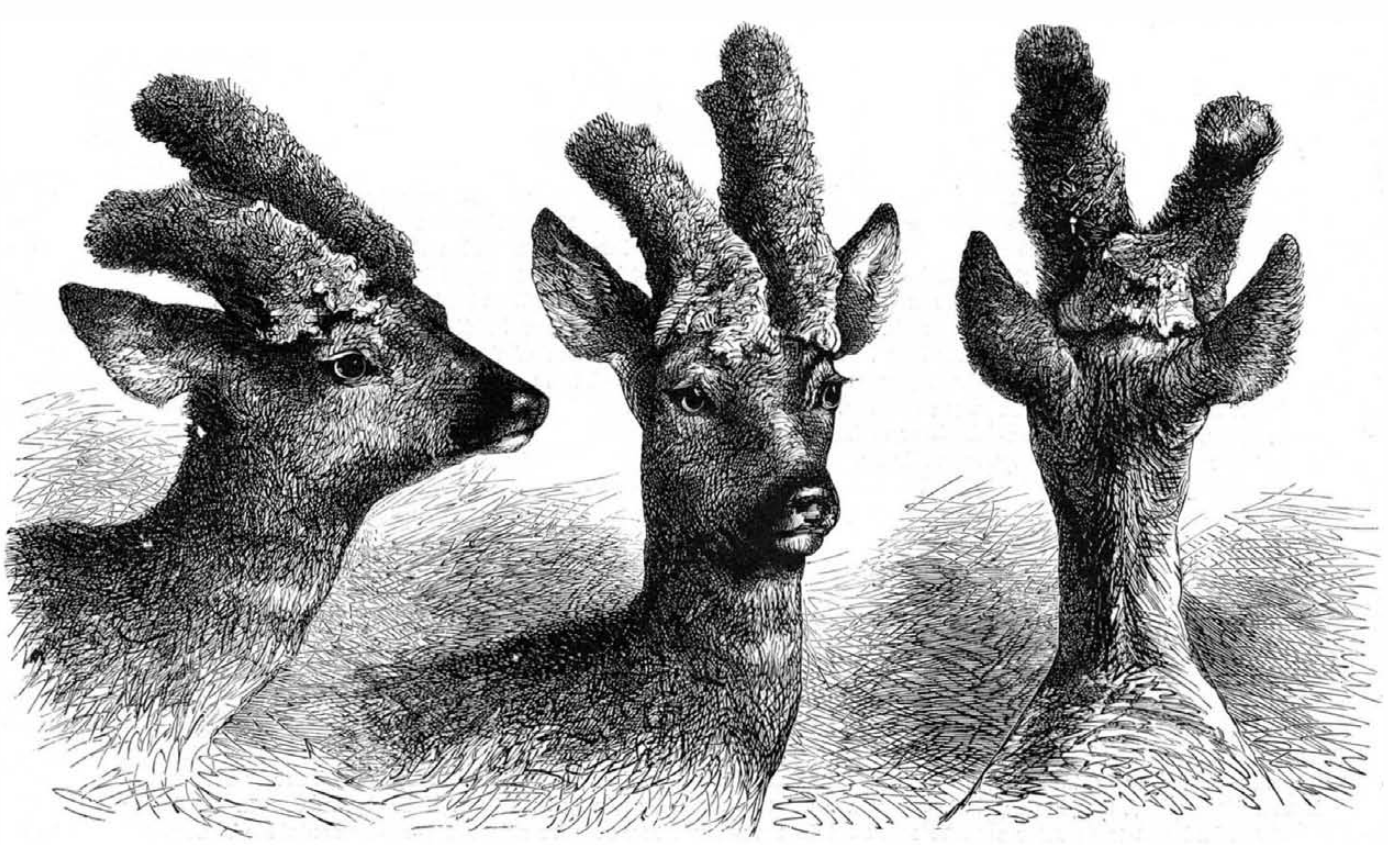
The section of wood shown in the engraving was sent by the Norwegian Government to the International Electric Exhibition at London. It was cut from a perfectly sound post impregnated with sulphate of copper. It is perforated with a hole, forming a circle of the diameter of about three inches and a half, which hole has been pecked out by the birds. Electric telegraph poles are frequently thus treated in Norway, in certain districts situated near pine woods, where the bird is found; the holes are, as a rule, at the top of the post. According to the opinion of an ornithologist, the motive should be attributed to the humming sound produced in the post by the vibration of the wire, which the



bird imagines to proceed from worms and insects working inside the post. The smaller bird depicted here is the green woodpecker (*Picus vividus*), the most common of our limited number of British woodpeckers. The larger bird is the great black woodpecker (*Picus martius*), whose native regions are the northern and eastern parts of Europe.

Pezzer's Accumulator.

This battery is constructed as follows: Narrow bands of lead, 10 to 15 millimeters broad and 500 in length, are obtained by cutting up sheets of a suitable thickness, and they are made to take a waved form by being passed between the rollers of a machine used for folding stuffs obliquely. Each of them is doubled in two, and they are placed in juxtaposition, fold upon fold. The free ends are then soldered together by the autogenous process, forming them into fringes. These fringes are introduced in place of the carbon and the zinc in a Bunsen element (Ruhmkorff's model), where some of them fill the porous vessel, and the others the interval between the porous vessel and the sides of the exterior vessel. The soldered ends are upward and the folds downward. Plates soldered to the upper part serve as electrodes.



PERUKE-HORNED DOE.

How Beeswax is Made.

I presume that the majority of people who are not bee-keepers suppose that bees gather wax from some source, in the same way that they gather honey, pollen, and propolis. I once heard even a bee-keeper remark: "We had a nice spring day yesterday. My bees had a splendid 'fly,' and I noticed that some of them came in loaded with pollen and wax." That bees do not gather wax is easily proved by confining in an empty hive or box, and feeding them honey or a sirup made of sugar, when they will immediately commence the construction of combs. During the working season wax is secreted by the bees, and forms in thin white scales, or flakes, between the rings, or segments, of the abdomen. Such renowned scientists as Prof. Agassiz and Tyndall have made some very amusing blunders (blunders which showed they had never seen bees building comb) in attempting to tell how honeycomb is built. The exact manner in which these little pellets of wax are formed into beautiful white combs is well described in the "A B C of Bee Culture," and I give a short extract:

"If we examine the bees closely during the season of comb building and honey gathering, we shall find many of them with the wax scales protruding between the rings that form the body, and these scales are either picked from their bodies, or from the bottom of the hive or honey boxes in which they are building. If a bee is obliged to carry one of these wax scales only a short distance, he takes it in his mandibles, and looks as business-like with it thus as a carpenter with a board on his shoulder. If he has to carry it from the bottom of the honey box, he takes it in a way that I cannot explain any better than to say he slips it under his chin. When thus equipped, you would never know he was encumbered with anything, unless it chanced to slip out, when he will very dexterously tuck it back with one of his fore feet. The little plate of wax is so warm from being kept under his chin as to be quite soft when he gets back; and as he takes it out, and gives it a pinch against the comb where the building is going on, one would think he might stop awhile and put it into place; but not he, for off he scampers and twists around so many different ways, you might think he was not one of the working kind at all. Another follows him sooner or later, and gives the wax a pinch, or a little scraping and burnishing with his polishing mandibles, then another, and so on, and the sum total of all these maneuvers is that the comb seems almost to grow out of nothing; yet no bee ever makes a cell himself, and no comb building is ever done by any bee while standing in a cell. The finished comb is the result of the moving, restless mass, and the great mystery is that anything so wonderful can result at all from such a mixed-up, skipping-about way of working."

In every apiary should be a box or barrel in which to throw all waste comb, and the cappings that are shaved off the combs when extracting. When much transferring or extracting is done, considerable wax can in this manner be saved, and it is as easy to save it as it is to throw it away. During the hot weather these refuse combs and cappings should be melted up into wax quite often; otherwise they will become infested with the bee moth's larvæ, and thereby destroyed. There are several methods of melting up combs and cappings into wax, but I have tried none that is more simple, or better, than to make a bag out of some coarse sacking, fill it with pieces of comb, tie it up, and put it into a wash boiler. Set the boiler on the stove and fill it nearly full of water. When the water is almost hot enough to boil, take a stick and punch, poke, and press the bag until the wax is all melted and risen to the top. Now lay a narrow strip of board across the top of the boiler, and tie it fast to the handles; then take two or three sticks that are nearly as long as the boiler is deep, press the bag down to the bottom of the boiler with these sticks, and keep it in this position by putting the upper ends of the sticks under the strip of board that is fastened across the top of the boiler. Now set the boiler off the stove, and when its contents are cold, the wax can be taken off in one solid cake. In passing through the bag the wax is cleansed from all coarse impurities, while the fine particles of dirt that do escape will be found either upon the top or bottom of the cake of wax, from whence they can easily be removed.

When the combs and cappings have all been worked up, and the cakes of wax have been scraped free from all dirt or sediment, the cakes should all be put into the boiler, melted up together, and the wax run into neat cakes.

I made twenty-five pounds of wax, last spring, in the above manner, and the nicest wax I ever saw. To clean

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utensils from beeswax, they should first be scraped with a knife as clean as possible, and then rubbed with a cloth saturated with kerosene oil. Beeswax is sometimes adulterated with paraffine, ceresin, or tallow. To detect these frauds, a piece of wax should be chewed; if adulterated, even slightly, with either, it will chew like gum, while, if pure, it will crumble and break to pieces in the mouth, and will not make gum at all.—*W. Z. Hutchinson, in Country Gentleman.*

Man and Insects.

The only nerves (worth mentioning) in the human body which are not under the control of the brain, are those of the heart and other internal organs; and over these parts, as everybody knows, we have not any voluntary power. But all our limbs and muscles are moved in accordance with impulses sent down from the brain, so that, for example, when I have made up my mind to send a telegram to a friend, my legs take me duly to the telegraph office, my hand writes the proper message, and my tongue undertakes the necessary arrangements with the clerk. But in the insect's body there is no such regular subordination of all the parts composing the nervous system to a single central organ or head office. The largest knot of nerve matter, it is true, is generally to be found in the neighborhood of the sense organs, and it receives direct nerve bundles from the eyes, antennæ, mouth, and other chief adjacent parts; but the wings and legs are moved by separate knots of nerve cells, connected by a sort of spinal cord with the head, but capable of acting quite independently on their own account. Thus, if we cut off a wasp's head and stick it on a needle in front of some sugar and water, the mouth will greedily begin to eat the sweet sirup, apparently unconscious of the fact that it has lost its stomach, and that the food is quietly dropping out of the gullet at the other end as fast as it is swallowed. So, too, if we decapitate that queer Mediterranean insect, the praying mantis, the headless body will still stand catching flies with its outstretched arms, and fumbling about for its mouth when it has caught one, evidently much surprised to find that its head is unaccountably missing. In fact, whatever may be the case with man, the insect, at least, is really a conscious automaton. It sees or smells food, and it is at once impelled by its nervous constitution to eat it. It receives a sense-impression from the bright hue of a flower, and it is irresistibly attracted towards it, as the moth is to the candle. It has no power of deliberation, no ability even to move its own limbs in unaccustomed manners. Its whole life is governed for it by its fixed nervous constitution, and by the stimulations it receives from outside. And so, though the world probably appears much the same to the beetle as to us, the nature of its life is very different. It acts like a piece of clockwork mechanism, wound up to perform a certain number of fixed movements, and incapable of ever going beyond the narrow circle for which it is designed.—*Grant Allen, in Knowledge.*

Domestication of Wild Ducks.

In a paper "On the Domestication of some of our Wild Ducks," Mr. Charles Linden, the author, states, after efforts to domesticate several of the species, capturing them young or raising them from eggs, that none of those transferred to the barnyard "adapted themselves thoroughly to this state excepting the Mallard, dusky duck, and Canada goose, the progeny of which prospered well and attained a greater weight and size than the ordinary domesticated stock. Some of them are still living, and betray in many instances a tendency to revert in point of plumage to their original condition, while the majority have become completely metamorphosed into ordinary barn yard fowl. No hybrids from any two different wild species, which bred only within the inclosure, were ever obtained excepting from crosses between the Mallard and dusky duck." The crossing was readily accomplished "without any need of resorting to special inducements." He says: "It is evident that the dusky duck is fully as domesticable as the Mallard, which has been thus far supposed to be the originator of our common tamed ducks."—*Bulletin of the Buffalo Society of Natural Sciences*, vol. iv., No. 2.

Fat of the Old and Young.

The influence of age on the chemistry of the body is a department of physiology as yet very imperfectly investigated. The composition of the fat, however, at different periods of life, is obviously one of the simplest problems connected with the question, and it bas been lately investigated by Lanquer. In newly born children the fat has a particularly firm consistence, constituting a peculiar tallow-like mass, with a melting point of 45° C. The fat of adults, however, separates, at the ordinary temperature of a room, into two layers. The upper layer is completely fluid, translucent, and of a yellowish color, and only solidifies at temperatures under zero Centigrade. The lower layer is a crystalline mass, which has its melting point at 36° C. Further investigations were made on about a kilogramme of each kind of fat. The fatty acids obtained from the fat of newly born children (after precipitation with hydrochloric acid) were found to melt at 51° C., and those obtained from the fat of adults had a melting point of 38° C. The former was found to contain three times as much palmitic and stearic acid as the latter. The palmitic acid preponderated over the stearic in each kind of fat, but much more in that of children than of adults, the proportion being in the former four to one, but in the latter nine to one. There are 86 per cent of oleic acid, 8 per cent of palmitic acid, and 2 per cent of stearic acid in the fat of an adult; whereas in the child the proportion of oleic acid is only 65 per cent. the palmitic acid 28 per cent, and the stearic acid 3 per cent.

Sugar in China.

From a report recently issued by the United States Consul at Canton, it appears that the cultivation of the sugar cane and the manufacture of sugar in China is at the present moment attracting considerable attention among the inhabitants of the Celestial empire, and statistics, published by the Inspector-General of Customs at Shanghai, show a considerable increase, of late years, in the export of sugar to foreign countries. The following method of cultivating the sugar cane is employed by the Chinese.

When the cane is cut down, the tops are removed, and bound in bundles, and the leaves of these top cuttings are taken off; the cuttings themselves, which usually have four or five joints, are placed in a pond of fresh water, where they remain in soak for some twenty days; at the expiration of this time the joints will have thrown out sprouts or buds, these sprouts are about four or five inches in length; the cuttings are then planted in rows, about two feet apart, and at an angle of about 60°. The cuttings, when planted, are slightly manured with bean cake, composed of compressed pulp of the yellow China bean, which grows abundantly in the northern portion of the Empire. It requires ten months, from time of planting, before the crop is matured and ready for harvesting. From the roots of this crop being well fertilized with the bean cake in a semi-liquid form, a second crop is produced; even a third is sometimes secured in this manner, but this is only when the soil is exceptionally rich. If the soil is not sufficiently fertile for a third crop, the roots are removed, the land cultivated and manured as for the first crop, and cuttings are planted every two years.

The cane, when cut, is collected in bundles, and conveyed by men or boats, according to locality, to the mill or crusher; this consists of two granite cylinders about three feet in length by eighteen inches in diameter, placed perpendicularly, the lower ends revolving in a stone socket, the upper in a frame of wood set into granite uprights; attached to or let into the upper end of these cylinders, are wooden cogs, and to the end of one of these cylinders is attached a strong wooden shaft or spindle, to the upper end of which is fixed a strong cross beam or lever, and to the outer end is attached the propelling power, which usually consists of four or five small oxen. The cane is passed between the cylinders, the juice running down into a small trench, which opens into a receptacle in the ground holding about twenty or thirty gallons; the juice is then conveyed in buckets to the boiling pans near at hand, and the cane, after being crushed, is taken away to be used as fodder. It is sometimes dried in the sun, and is used for fuel for boiling the sugar. The boiling pans are of cast iron, the greater part of those used being made at Fat Shan, about fifteen miles from Canton. They are about eighteen inches deep by four feet in diameter, and are placed in brickwork side by side, usually four in number, with arches for fuel underneath, all covered with a mat or thatched shed. Three kinds of sugar are manufactured, namely: "rock candy," "green sugar," and "clayed sugar." The rock candy is made as follows: The sugar is placed with a sufficient quantity of water in a large boiling pan, similar to the ones already described, and boiled down to the proper consistency, which is ascertained by putting a small quantity into cold water; if it hardens at once, it is then time to run it off into earthen jars—these jars holding about fifty pounds each. They are always broken in three or four parts, and the parts are then bound together with a small quantity of lime cement and a few bamboo or rattan hoops. The hot liquid is then put into these broken jars, and a network of basket splints is placed over each, the ends of the splints extending in different directions through the liquid to the bottom of the jar. If the temperature is cold, it will crystallize in about fifteen days; if warm, it requires from twenty-five to thirty days. As it crystallizes it adheres to the splints, the portion not crystallizing settling at the bottom. The jars are then placed with the bottom part turned partly up over empty ones to allow the molasses to run out. When sufficiently drained, the jars are removed, the hoops taken off, and with a small hatchet the parts again broken asunder; the candy is then removed from the splints and spread out in the sun for a short time to purify or bleach. It is then assorted and packed into wooden tubs holding from forty to fifty pounds each.

Two qualities are always found in the jars; that at the bottom being darker and of less market value. The drainage from these jars is reboiled, and a poorer quality of brown sugar produced; from the refuse remaining after this last process a cement is made by mixing with lime. The process pursued in the manufacture of "green" sugar is as follows: The juice is boiled in the month of December, as it is taken from the crushers in buckets in one of the four iron boiling pans; a man is in attendance who pours the juice from one pan to the other. As soon as the liquid boils, a small portion of lime is put in, and the white of one or two eggs is placed in each pan. After a time the dirt and refuse come on the surface, which is all skimmed off from time to time, while the sugar is boiling. When sufficiently boiled, it is run off into a wooden cooler, about seven feet long, four feet wide, and one foot deep; and while in the hot liquid state, a man begins to stir it about with a piece of wood about a foot-and-a-half long, and an inch thick, attached in the center to a handle about four feet long. With this wooden instrument the liquid is kept in constant motion, until it begins to granulate and cool, and when cool enough, several men mix and rub it with their hands until all the lumps are bruised and the sugar becomes all of one color, which is a dark yellow. It is then put in baskets, and sold to sugar dealers, who put it up in mat bags, and bring it to markets for sale to merchants for shipment.

The sugar principally exported to foreign countries is what is known as "clayed" sugar, and is made as follows: When the juice is boiled to a proper consistency, the whites of two eggs are put into each pan, which serves as a clarifier; when sufficiently boiled, it is run off into conical-shaped earthenware jars, which are placed in rows either over trenches or empty jars. In the bottom of each jar containing the sugar is a small aperture in which is placed a wisp or bung of straw; when the sugar has become sufficiently granulated by cooking and an occasional stirring, the straw bung is slightly loosened, the portion not becoming sugar escaping into the trench or empty jars. When sufficiently drained, a thin layer of straw is placed over the sugar, and over this a thick layer of clay. The jars are then packed away in a dry place, where they remain from thirty to forty days, according to the state of temperature. The coverings and straw bungs are then removed, and each jar will be found to contain three qualities or grades of sugar, the upper part being white, the next light brown, and at the bottom a dark brown. The drainings are sometimes used for distilling purposes, and also for making cement. It appears that two distinct kinds of cane are grown in China, one being of a dark purple color, and this is better for sugar than the other, which is green, and quite tender; the latter is principally sold in pieces about eight inches to ten inches in length, to the natives, who eat it in its raw state.

An Improved Coffee.

The kola seeds, called also ombémé nuts, are the produce of *Sterculia acuminata*, belonging to the natural order Sterculiaceæ, and are known to us by the accounts of West African travelers, who state that when chewed or sucked, they possess the power of rendering the flavor of water, even if half putrid, agreeable, and they were believed to contain caffein. They have recently been made the subject of analysis by MM. Ed. Heckel and Fr. Schlagdenhauffen, who, according to the *Lancet*, have found that they do actually contain more caffein than the best samples of coffee that could be procured, and that this base is altogether free and uncombined—not, therefore, as in the coffee berry, united with an organic base; secondly, that they contain a very appreciable quantity of theobromine, which assists the action of caffein, and possesses similar properties to that base; thirdly, which is an important fact, that they contain a considerable quantity of glycose, of which cacao presents no trace; fourthly, that the quantity of starch present is three times greater than that contained in theobroma, which explains its nutritive value; fifthly, that there is but little fat, in which respect it differs notably from cacao; and, lastly, that they contain a special form of tannin, which approximates caffeotannic acid in its composition, and a red coloring matter, very similar to that named by Payen cacao-red. The physiological examination of this substance has shown that its properties are essentially due to the caffein and theobromin it contains. The seeds, it appears, have long been in use in Soudan and Western Africa, for the relief or cure of diseases of the intestines and liver, and especially in cases of atony of the digestive tract, and also as a masticatory and tonic, like the areca nuts, which are held in such high esteem by the natives of India. Medically they may come to occupy a prominent place by the side of coca and other anti-metabolic remedies, to which they would probably prove superior in consequence of the tannin they contain.

Solids into Solids.

Colson has observed that if an iron plate is heated in lampblack not only the carbon penetrates into the iron, converting it into steel and then into cast iron, but also considerable quantities of iron diffuse into the carbon. If the heating be sufficiently prolonged, this diffusion may be shown to take place even at 250°. If a piece of piano wire, embedded in lampblack, be heated to redness in the reducing flame, it loses weight. Platinum under these circumstances shows no change. Since platinum does not combine with carbon, it appears that a diffusion occurs between solids only when they can react on one another. Pure silver loses weight when heated in pure dry alkali chloride. But the product darkens on exposure to light; hence silver chloride must have been formed, free alkali having been produced by the oxygen of the air. If a polished piece of artificial iron sulphide be heated on a plate of copper in a current of CO_2, small quantities of sulphur go from the iron to the copper. If a piano wire be heated in a crucible lined with carbon and filled with lime, the wire increases in weight and shows on analysis the presence of calcium.

Logwood in Wine.

Twenty c. c. of the wine are shaken up with two grammes manganese peroxide and filtered. The liquid produced, which is brown even if no logwood is present, is treated with zinc and hydrochloric acid. The humic compounds are thus reconverted into hæmatoxylin, which may be detected by the usual reagents.—*Giornale Farm. Chim.*

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Sash Windows.

The sash window is one of those modern inventions which persist in spite of tastes and numerous modifications. It seems to have been introduced about the period of the Classic revival in England, and to have maintained its position as the most convenient kind of window fitting. Architects have never been very partial to it; during the Gothic mania it was abused more than any other feature of modern houses, and was pronounced one of the ugliest remnants of Classic taste. The French casement and the mullioned window have been always more popular. One of the stock arguments used by the Gothicist during the "Battle of the Styles," was the use of so prosaic a form, while on the other side the Classicist was not inclined at all at that time even to defend a feature which he had been endeavoring to improve. As every one knows, there was, and is still, a strong desire to conceal the framework, either by painting the woodwork black or some dark shade, or by inserting plate glass in the frames. We have lived to see a very opposite fashion set in. The Queen Annist rejoices to make the frames a visible part of the window, and to fill the sashes with as many small panes of glass with thick white bars as he can. But it is with the various improvements that have been made in the mechanism of the sash window that we are now concerned. Several modifications have been made and patented for opening window sashes and for cleaning them. Though the casement window has been admired, it has had a bad reputation for failing to keep the wet out, in spite of numerous ingenious appliances for fastening. The recent patents that have been brought out for lifting windows, and for enabling the sashes to be opened for cleaning, are evidences of a desire to improve and perfect an appliance that has met with public approval, and which is now a pronounced feature in modern houses. The chief mechanical drawbacks of the sash window are the difficulty of raising heavy sashes, the want of a lifting power, the tendency of the sash to hang on one side, difficulty of cleaning the sashes, the breakage of the cords, the inefficiency of the usual window fastenings, and the rattling of the sashes in windy weather. Many, if not all of these drawbacks have been made the subjects of patents. Thus we have the admirable arrangement of Mr. R. Adams, the "anti-accident window," by which the sashes are balance pivoted, so that either of the sashes can be turned round so as to enable the outside to be cleaned without risk of accident; another (Philips') "reversible" window, constructed on a similar plan, and for the same purpose, by which the ordinary sashes can be made to swing round for cleaning from the inside. In this case the sashes are hung clear of the slips and inside bead; the check to the wet being made by rabbeting the side of the sash and fixing in it a metal bar with a screw, the latter being made to form the pivot for turning on. Other various patents have been introduced for hanging the sashes, so that they may be removed from the frames without taking off the inside beads. Gurman's sash pocket is a simple method, though not now generally known, by which the weights can be easily taken out and the sashes cleaned. Bullivant's patent is another well known modification. Messrs. Leggott are the patentees of a window lift and fastener which command approval. By the action of a screw working into a rack in the sash frame both sashes can be opened simultaneously, or only the bottom sash. Sash cords and weights are thus dispensed with, and a source of trouble and expense avoided, and no sash fastener is required, as the sashes are locked by the screw and rack motion in any position. Another invention recently patented, the "imperial window," facilitates ventilation and cleaning. The top sash is made longer to run up into a casing about 12 inches, so that it can be lowered for ventilation at the meeting rails, and other improvements are made by which the sashes can be readily taken out and cleaned. The old fashioned sash lines and weights are certainly behind the age; the inconvenience, difficulty of removing the beads, taking out the pocket pieces, and repairing the lines, are well known by all householders, and any suggestion for hanging the sashes without cords and weights is worthy of consideration. There is, of course, a mechanical difficulty in doing this so as to allow only one sash to be opened at a time, but it is easy to devise means of getting at the weights and cords without the trouble it now entails. It is an advantage, too, to make the sashes so that they can be balanced on pivots, or raised in a horizontal position. The air-tight tongues which are withdrawn into grooves by turning a key enable either of these positions to be attained very quickly, as in Mr. R. Adam's reversible window; and windows with these movable tongues can be made very air and dust tight—not a small advantage in crowded town streets.

Many devices have been proposed for opening and closing sash windows, particularly wide heavy sashes with plate-glass. One of the best of these is Meakin's "self-acting sash fastener and opener," too well known to need description here. In the same class of appliances the architect ought not to lose sight of Adam's patent fanlight opener, or the rack and screw adjustment of Messrs. Leggott. It is unnecessary to name other ingenious appliances of the same kind, our object being merely to indicate a few of the principal aims, in all of which the advantages of the sliding sash window are preserved and maintained. The simplest of these appliances are the best. The advantage of the sash window over other forms is that it does not occupy room; it can be opened or closed in its own area (a great consideration in town houses), the sashes can be regulated at pleasure to allow any amount inlet and outlet of air, one of the best forms of ventilation, and, if properly constructed, it is the securest form of window, and the most water-tight. The present style of building has brought the sash window into repute again, and the villas and suburban dwellings of the metropolis are now all filled with them. Few of these, however, are fitted up in a style superior to that of windows of fifty years ago. Very seldom we find any attempt made to introduce improvements of the kind we have mentioned. The sash lines and weights are of the commonest description, the pulley stiles have no arrangement for easy access to the weights, the sashes shake about, and the window sill is seldom properly double sunk or grooved; the fastenings are of the most trumpery kind, and there is no plan by which the sashes can be cleaned except by getting outside. It may be asked, why are not these inventions now more generally adopted? The speculative builder has no inclination to introduce specialties in building; so long as the tenant is satisfied with the old arrangements, he does not feel himself justified in going in for fittings of an expensive character. The smaller class of tenants have not the desire or inclination of saving trouble to themselves or promoting their own comfort; but the architect has no such excuse to plead for not specifying the best means of saving the domestic labor and insuring domestic completeness. Some of these appliances have been disregarded by the profession on account of their complexity, or that they are too cumbrous for everyday use; and this is a fault which inventors are very apt to commit, and which a little more thought would have enabled them to avoid.—*Building News.*

Ammunition in Recent Great Campaigns.

SOME interesting statistics have been lately compiled relative to the amount of ammunition provided and expended in some of the greater campaigns of the present century. At the time of the outbreak of the Franco-German war of 1870-71 the small-arm ammunition equipment of the Prussian infantry amounted to 169·5 cartridges per rifle, exclusive of 6,000,000 rounds, or about twelve cartridges per rifle stored in the army reserve ammunition part, which brought up the number of cartridges per rifle to nearly 180. The French infantry was even more amply supplied with ammunition at the beginning of the campaign, taking with it 143 rounds per rifle, while in the great part there were 137 rounds per rifle, thus raising the total supply per rifle to 280 cartridges. Unfortunately, only very scanty official statistics are forthcoming as to the actual expenditure of cartridges during the war, but official returns show that during the whole campaign the 2d Bavarian army corps expended 2,050,260 cartridges, or an average of ninety-one rounds per rifle, and this expenditure is believed to be as high as that of any other corps of the German army, since, according to statistics collected in the Prussian Ministry of War, the twelve Prussian army corps and the Hessian division only expended together 12,000,000 cartridges, or about the same quantity that, according to report, was consumed by the French infantry, 180,000 men strong, during the three days' fighting at Leipsic in 1813.

No information is obtainable as to the expenditure in the other corps of the German army; but even assuming that their expenditure was as great as that of the 2d Bavarian Corps, the average number of cartridges expended per rifle throughout the whole of the German forces during the whole war would only amount to fifty-six. No trustworthy records at all are obtainable as to the total expenditure of ammunition by the French army; but, according to General Rivière, the French army, during the fighting in the neighborhood of Metz on the 15th and 18th August, 1870, expended 1,561,722 cartridges, or on an average thirteen rounds per rifle; while, according to another authority, the total expenditure during the battles of Forbach, Borny, Gravelotte, St. Trivat, in fact, during all the actions fought by the army of the Rhine before it was finally imprisoned in Metz, amounted to, in round numbers, 3,500,000 cartridges, or about thirty rounds per rifle.

Going back to the war of 1866, we find a most striking disparity between the consumption of ammunition by the two belligerents. The supply of small arm ammunition per man in the Austrian army when the war began was about 137 rounds per rifle; while the expenditure in Bohemia is stated to have reached sixty-four cartridges, and in Italy fifty-seven cartridges, per infantry soldier. In these numbers, however, the ammunition lost and spoilt is included, and it is very certain that the quantities lost and spoilt must have been enormous. On both theaters of war the campaigns were virtually decided in a very few days; on neither was there any prolonged fighting, so that it is incredible that anything approaching the number of rounds said to have been expended can have been actually fired. In the Prussian army, indeed, only 2,848,556 cartridges, or on an average seven rounds per man, were expended.

In the Crimea enormous amounts of ammunition were provided and expended. The equipment of the French army at the outset of the operations included 150 cartridges for each musket, and this supply was afterwards increased by the formation of large ammunition depots at Varna and Gallipoli to 360 rounds per musket; while, before the conclusion of the war, 1,000 rounds per musket had been collected, the total stores amounting to 80,000,000 cartridges, while the average effective of the French infantry was in round numbers 80,000 men. During the war 28,500,000 cartridges were either fired, lost, or spoilt by the French army, giving an average expenditure of 350 rounds per musket; but of the total amount a very large proportion was lost by the foundering of transports and storeships and by the explosion of magazines, while the waste of ammunition in the trenches was notoriously very great. On the other side the Russians, according to Gen. Todleben, used 16,500,000 cartridges in the defense of Sebastopol, and since the garrison numbered at the termination of the siege 115,000 men, and the siege lasted for 349 days, it is probable that this number is no exaggeration.

Going back again to the wars at the beginning of the present century, we find that in 1809 Napoleon's army was provided with 200 cartridges per infantry soldier, while in the Austrian army 31,000,000 cartridges were provided for an army comprising 250,000 infantry, the supply being therefore at the rate of 124 rounds per musket, while the expenditure amounted to 42 rounds per man.—*Broad Arrow.*

Sound Shadows in Water.

In experimenting, long ago, on the velocity of sound in water, Colladon noticed incidentally that when the end of the hearing tube plunged in the water became screened, by a projecting wall, from the immersed bell, the sound was remarkably lessened in intensity. These "sound shadows" are known to be much more distinct in water than in air. An interesting contribution to this subject has been lately made by Professor John Le Conte, of Berkeley, California, who got his son a few years ago to watch the blasting with "giant powder," or dynamite, of a sandstone reef 15 feet below low-water level in the harbor of San Francisco. The suddenness of the shock of each explosion had striking effects. At a distance of 300 feet two distinct shocks were experienced—one came through the water and was felt (in a boat, or on a wooden pile) as a short concussion or blow before the water sensibly rose over the point of explosion; the other came later by the air (to which it was evidently communicated by the water when the elastic pulse emerged at the place of explosion) and was heard. The gases generated came to the surface much later than this second shock, raising a column of water 25 feet to 30 feet. The concussion caused by the explosion killed or stunned the fish within a radius of 200 feet or 300 feet. The "sound shadow" experiments consisted, first, in lowering in various positions soda-water bottles attached to rigid rods from the top of a vertical pile about one foot in diameter and about 40 feet from the explosive cartridge, which held about 15 pounds of the compound. The bottles were shivered when outside of the geometrical shadow of the pile, but protected when within it; and it was so whether they were filled with water or air. Next, cylindrical glass tubes (6 feet long, 1½ in. in diameter, and half an inch thick) were attached to frames and plunged in a horizontal position behind the pile. In each case the portions projecting beyond the limits of the shadow were shattered, while the middle of the tube, in the shadow, was saved. A tube being lowered 12 feet beyond the pile, its protected portion was sensibly equal in length to the diameter of the pile; showing that the shadow extended back between sensibly parallel vertical planes. It is noted that the surface of the water just over the explosion exhibited numerous jets of water rising about 3 inches in the center of the area. The distinctness of "sound shadows," like those of light, should depend (according to theory) on shortness of wave length, and Professor Le Conte endeavors to show that this must apply to water as well as air (in which acute sounds cast more distinct shadows than grave ones). Where the time of a blow or explosive impulse is exceedingly brief, the wave-length must be proportionately short. Now the efficiency of surface blasting under water with nitro-glycerine compounds depends on the extraordinary suddenness of detonation, and the wave generated in an elastic medium like water must be very intense and very short, so that an obstacle will give a sharply-defined shadow. The author thinks that waves from the less sudden explosion of gunpowder should therefore give less definite shadows.

Sulphite of Soda for Development.

For preserving from discoloration we have found two ounces of sulphite quite sufficient for one ounce of pyro. The formula then will run: Pyrogallic acid, one ounce. Dissolve in water containing thirty grains of citric acid, and add solution of sulphite of soda, as above, four ounces. Then make up the whole to ten or twenty ounces, according to the operator's usual plan. We have then a stock solution easily made, always in order after the lapse of months, and capable of developing a negative perfectly free from the well-known yellow color of pyro.

We will conclude by stating that we have experimented with various samples of the sulphite, and have not found much difference in their respective effects; but it will be well to point out that, as this salt is not found in every chemist's shop, stress should be laid upon the fact, when ordering, that *sulphite*, not *sulphate* or *sulphide*, is wanted. Chemists are so used to their customers' ignorance of chemical nomenclature that they might think an error had been made in asking for a little known chemical.

The special kinds we tried were the commercial and the recrystallized sulphite, the latter costing four or five times as much as the former. The latter is a nicer looking and a purer salt, but we failed to find any superiority in its color preventing properties. We, however, decidedly recommend the recrystallized on the grounds of its probable greater uniformity—a consideration which we consider is too often lost sight of, but which for the best results it should always be the photographer's aim to attain.—*British Journal.*

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The Value of System and Drill.

The danger to which the pupils of public schools in large cities and towns are constantly exposed, on account of the crowded condition of such buildings and the liability of a panic occurring in the event of an alarm of fire being raised, has, in only exceptional cases, been fully appreciated, and even when the danger has been recognized, little or nothing has been done to provide for or counteract the same. This state of affairs may, perhaps, be accounted for by the fact that members of school boards, as a general thing, know a great deal more about the contents of ancient histories than they do about the practicalities of life in the nineteenth century. School houses are now seldom built as they should be built, and, as a consequence, danger continually menaces their inmates. A fire is liable to break out at any moment, and owing to the presence of innumerable flues for hot and cold air, which are almost always made of wood, flames are apt to seize upon such a structure in a very short time. Wooden staircases, which make an angle every few feet, and long halls or passages lead to the various rooms, and it is a mystery that more lives of school children than are lost by fire are not sacrificed. Few boys or girls have passed through the public schools without having been more than once disturbed by an alarm of fire, usually false, we will admit, but none the less dangerous. Boys like excitement, and, glad of excuse to vary the wearisome monotony of school life, accept the slightest intimation of a fire, and try to induce a panic. A puff of smoke from a register is enough to send them rushing pell-mell downstairs. Some school buildings are naturally less likely to burn than others, although none are any too well constructed; but there is no reason why lives should be lost when a fire does break out. By employing some system in the management of the inmates, nearly all danger from this source can be obviated, and there is sufficient cause to employ system of this kind. The fire hazard in school buildings is very great, and few last many years before they are swept away by flames.

A resolution has been offered before the New York Board of Education that the principals of the several schools and departments shall, under the direction of the superintendent, train the pupils in their charge, so that they may be able to leave the building, in an emergency, in the shortest possible time, without confusion or panic. Ever since the occurrence of a lamentable panic, which was caused in one of the largest schools of the city, many years ago, by an alarm of fire, and whereby many children lost their lives, the teachers have done more or less on their own responsibility to drill their scholars in marching in regular line, so as to prevent confusion. The panic referred to was unnecessary, there being no fire; but it was exceedingly disastrous in its results. In the schools of Louisville, we believe, an admirable system of fire drill exists. The same practice obtains elsewhere in a few places, and indeed we described some months ago the fire extinguishing brigade which had been organized among the older scholars of a large Western school. A regular fire company was maintained on each floor, under the control of the usual officers, and all under the authority of the teachers. This corps had been organized to fight a fire should one break out. The idea was, of course, well intended, but its value is to be doubted. The most that can be expected of the pupils is to so conduct themselves that their safety may be assured. It would be a very simple matter for the teacher of a school to make his or her pupils adopt some method of marching to and from classes and from the building after the work of the day has been done. Then, should a fire break out, if, instead of raising a general alarm, announcement of the fact was conveyed to the superintendent, every teacher might speedily be informed, and by some ruse the scholars dismissed without a suspicion of what was occurring. The first knowledge the majority of them would obtain of the fact that the building was on fire would be after they had reached the ground and were beyond all danger. Should a school of three thousand pupils be dismissed without order, the weak would inevitably be trampled upon by the strong.

Chiefs of fire departments in towns where no system of this kind is in force should earnestly recommend its advantages to the school authorities. The same plan might be enforced in large factories where numerous girls and women are employed. If it is possible, and it undoubtedly is, to preserve the safety of children and unsuspecting girls and women by the exercise of a little ingenuity and patience in drilling them to observe order in their going out and their coming in, it is a pity that grown folks will sacrifice their lives when a modicum of self-possession in the presence of danger would, in nine cases out of ten, enable them to escape unharmed. Self-possession and method will frequently accomplish wonders. The great trouble in protecting mill property and similar establishments from fire is in obtaining well-directed labor in the time of danger from the employes. Private fire brigades are almost useless, unless they are thoroughly organized and composed of cool-headed men of judgment, who will not become panic-stricken at the sight of a little outburst of flame. The principal reason why private fire brigades do not do good work, as a general thing, is undoubtedly because they are composed of men who are directly interested in the preservation of the property endangered. That is, they will always be affected financially by the destruction of the premises. It is paradoxical to say so, but it is nevertheless true, as every fireman knows, that when a person is himself concerned in the result of a fire he is usually unfitted for doing much toward extinguishing it. Take the average member of the best fire department in the country, and we venture to say that he would become "rattled" if his own house caught fire. A man entirely disinterested can do much better service, provided he understands his duty, than a man, just as good at other times, who would be out of pocket should the fire gain headway. It is, perhaps, too much to expect that everybody will become so constituted that self-possession will at all times be maintained. However, training will do much toward overcoming this difficulty.

The proprietors of a large carpet-weaving factory in New York have adopted a novel idea to protect their property from fire, and at the same time lessen their rates of insurance, for such indemnity against possible loss by fire can seldom be dispensed with entirely, no matter what efforts are made. The establishment is one of the largest of its kind, and the process of manufacture is more or less hazardous. Several times much damage had been caused by fire, and much financial loss occasioned by the loss of time as well as by the destruction of property. Spontaneous combustion was the great foe to be dreaded, and after having been burned out more times than they thought necessary they went to the Board of Fire Commissioners for advice. The ordinary dangers of such establishments were made evident to them, and several changes were made in the buildings so as to make them less apt to burn. Then, upon the recommendation of the Commissioners, a former member of the fire department was employed and given power to organize such a corps of fire-fighters and watchmen as he deemed proper. A half dozen men of experience as firemen were engaged, and now, at six o'clock every evening, this little band of men go on duty. The factory is thoroughly equipped with all requisite fire apparatus, and the first thing done is to unreel all the hose and lay it upon the floors. Of course it is constantly fastened to the pumps, and steam is always raised. Tours of the various departments of the factory are made at regular intervals, and in case fire is discovered, the facilities for informing the men and massing them at the required point are such that no delay of any kind is ever caused. An alarm is also sent to the regular fire department of the city at the same instant. Numerous fires have broken out in this establishment since this plan of self-protection has been in operation, but not one has got beyond the control of the men in charge. The same plan, on a modified scale, is in use during the day, all the employes being regularly drilled by the head officer. Putting out fires has come to be a business by itself, and method has taken the place of the "go-as-you-please" style formerly in vogue everywhere. Organized labor, well applied, will accomplish much more than the best intended individual efforts.—*Fireman's Journal.*

Causes of Fires.

A number of the leading insurance companies of London have been trying to discover the causes of fires which occur in dwellings. The *Fireman's Journal* says: It is estimated that twenty per cent of such fires are the result of gas or other light coming into contact with curtains or window blinds. Of course this proportion applies only to fires in cities. Clothes or other articles drying at fires in stoves or fire places are thought to be responsible for sixteen per cent of the fires which destroy the homes of the people. To defects in stoves, flues, etc., is due about a like percentage, These are the principal causes of fires in private houses, making at least one-half of the whole. Carelessness in one form or another is undoubtedly responsible for at least three-fourths of all fires that occur, be they in dwellings, warehouses, stores, on ships, or in powder mills.

Cæsium.

Setterberg has worked up the tons of alums obtained in Marquart's laboratory as a by-product in the preparation of lithium salts from lepidolite, with a view to obtain larger quantities of the salts of cæsium and rubidium, and if possible metallic cæsium itself. Three or four hundredweight of the alums were dissolved in so much water that at the boiling temperature the liquid marked 20° B. The solution was decanted and allowed to stand 12 to 14 hours. The mother liquid contained no trace of cæsium or rubidium salts, but the crystals were rich in these metals; the author having found that each of the different alums is insoluble in saturated solutions of the more soluble ones. Hence so long as the solution of the alums was saturated with potassium alum it contained scarcely a trace of the other alums; and the solution showed no trace of cæsium, so long as it was saturated with rubidium alum. By repeating this process the alums were obtained pure. Search for other alkali metals gave a negative result. In 14 days, Setterberg prepared 40 kilogrammes rubidium alum and ten kilogrammes cæsium alum, both pure. At 17° C. 100 parts of water dissolved 1·42 parts of rubidium alum and 0·38 part of cæsium alum. For the preparation of other salts, the alums were decomposed with barium hydrate, and the filtrate neutralized with the acid whose salt was desired. In this way the acid tartrates and the cyanides were prepared. For the preparation of metallic rubidium, 1,500 grammes hydrogen ubidium tartrate, 150 grammes calcium carbonate, and the required quantity of sugar were mixed and calcined, and the mixture transferred to a mercury flask and distilled. The yield was very satisfactory. A kilogramme of hydrogen cæsium tartrate similarly treated afforded no result. The electrolytic method was then employed, first with the chloride, and then with the cyanide of cæsium. Finally a mixture of 4 molecules of cæsium cyanide and one of barium cyanide was found to give a satisfactory result, the metal prepared showing in the spectroscope only a trace of sodium as an impurity. Cæsium resembles closely the other alkali metals. It is silver white, malleable and very soft at ordinary temperatures. Thrown on water it bursts into flame, and swims about on the surface like potassium and rubidium. It inflames in the air when not protected. It fuses about 26·5°, passing through a pasty condition. Its specific gravity is 1·88 at 15° C.—*Liebig's Ann.*

A Contortionist.

Mr. Charles H. Warren, an American acrobat and contortionist of some fame in his own country, is at the present time, says the *Lancet*, in London, exhibiting his remarkable power of dislocating many of his joints by voluntary muscular action. He is the child of healthy parents, and the first indication of any abnormality was that he was frequently tripped up by some displacement of the hip joint, when quite a young child; the fall, however, served to replace the bone. After two or three years he grew out of this tendency. At eight years of age he began to train as an acrobat. He does not make use of his power of dislocation to aid him in his performances, nor does dislocation now ever occur involuntarily. He is the father of two children, a son and a daughter, both of whom showed the same peculiarity, so far as the hip joint is concerned. He is a tall, well-developed, finely-proportioned man. His muscular development is uniform and great. By voluntary muscular contraction he dislocates forward either or both condyles of the lower jaw, downwards (partially) the head of each humerus, forwards or backwards (partially) each carpus, upwards and backwards (completely) the head of each femur, and backwards and forwards (partially) each of the phalanges of the fingers and thumb. With the aid of his hand he partially dislocates to either side the carpus, and forwards and outwards the ankle joint; when the knee is flexed he can rotate the tibia very freely, and make the inner condyle project an inch in front of the femur. Each of these displacements is accompanied by a distinct snap, but the replacement of the bones is noiseless and without effort. The most remarkable, as also the only complete, of these dislocations, is that of the hip. He stands at ease with the toes turned further out than is usual, and has unusual freedom of eversion of the lower limbs. When the femur is displaced, the great trochanter is raised and drawn back on the pelvis, and is still very prominent; the limb is shortened and inverted, and knee and hip joints are flexed; the head of the bone cannot be felt.

The explanation of these facts is that the man's ligaments are unusually lax, while his muscular power is very great, and probably also the rim of the acetabulum is less prominent than usual. In addition, Mr. Warren shows other illustrations of his remarkable power over his muscles, which are of fully as much interest as the foregoing. Thus he can contract at will the two pillars of the fauces, the platysma myoides, and the pectoralis minor, and can fix the elbow joints by strong contraction of either the arm or forearm muscles, or of both simultaneously. He voluntarily produces the deformity of talipes equinus and talipes equinovarus. Equally interesting is his control over the muscles of the trunk. Thus he can contract his recti abdominis in a wave-like manner, and illustrate capitally the formation of phantom tumors. He can contract his abdominal muscles quite back on the spine, so that the abdominal aorta is seen, as well as easily felt, pulsating. He also expands his chest to an enormous size, and can contract it so completely that the front becomes quite concave. These are merely examples of muscles unusually developed, and brought under the influence of the will to a most remarkable extent; they do not betoken any congenital peculiarity.

Benjamin Franklin Delano.

Captain Benjamin Franklin Delano, formerly U. S. Naval Constructor, died of old age at his residence in Brooklyn, N. Y., April 29. He was born near Boston, Mass., in 1809, and came of a historic family. His grandfather built the famous Constitution, long known as Old Ironsides. Mr. Delano came to Brooklyn in 1825, as apprentice to his uncle Samuel Hartt, then naval constructor at the Brooklyn Navy Yard. After acquiring proficiency in his business, Mr. Delano was sent by a Boston company to Grand Island, above Niagara Falls, where he draughted and constructed the first and several of the largest merchant vessels of that day for use on the great lakes. In 1847 he was appointed naval constructor, as the service was then constituted, and built the steamer Saramac at the Portsmouth Navy Yard, that being one of the vessels to introduce steam into the service. The Fulton and Powhatan were the only steamers previously built. He supervised at the same time the floating dry dock and basin in that yard. Late in 1849 Mr. Delano was ordered to the Brooklyn Navy Yard, which then employed about 1,200 men. The demands then made upon the Government for vessels were caused by the African slave trade, Commodore Perry's expedition to Japan, and by Dr. Kane's polar expedition. The Iroquois, of the same class as the Hartford, which became famous, was built by Mr. Delano, and was pronounced one of the finest specimens of naval architecture ever designed. During the civil war Mr. Delano constructed many vessels. He took a personal interest in the Tennessee, the Wampanoag, and the Miantonomah, the latter being the first iron clad to cross the Atlantic. In 1863 he was retired with the relative rank of captain, which he held at the time of his death.

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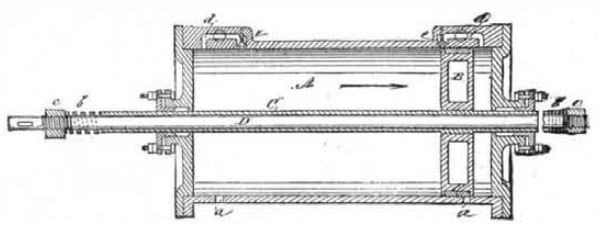
ENGINEERING INVENTION.

Steam-Cushioned Cylinder and Piston.

Mr. William Hanna, of Gilroy, Santa Clara county, Cal., has patented devices by which the concussion in the operations of pistons in steam cylinders is obviated. The device is cleverly shown in the accompanying engraving, in which A is a cylinder with the usual steam ports, and a piston, B, fixed on a tubular rod that works through stuffing boxes in both cylinder heads. D is a rod extending through and carrying the tubular rod and the piston, and connects with the crank; on this rod, near the ends of the tube, are screw collars, between which and the ends of the tube are spiral springs. These springs are adjusted in their tension by turning the screw collars, and allow endwise movement of



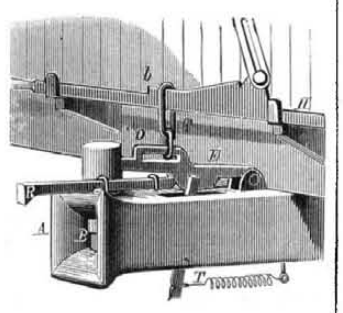
the tube on the rod under the steam pressure. The cylinder, A, is provided near each end with a U-shaped port opening at both ends into the cylinder, and fitted in the end most distant from the cylinder heads with a check valve opening outward. These ports are placed in such relation to the steam ports as that they are open at opposite sides of the piston, B, when the piston covers the steam port and before it has reached the end of the stroke, thus furnishing a passage for live steam from behind the piston to the front for cushioning the piston. It will be seen that this steam is taken from that in use, and the volume of steam used for cushioning, instead of being immediately exhausted, remains to start the piston back, thus effecting a saving.

An Improved Car Coupling.

Mr. Michael Winter, Sr., of Union City, Randolph county, Ind., has patented an improved device for coupling cars automatically.

The annexed cut is an illustration of the device, in which A is a drawhead provided with an end aperture, B, and on the upper side of which a lever, C, is pivoted to swing vertically in such a manner that the free end is at the front of the drawhead, where it passes into a slot in the head of the coupling pin, said pin passing through a vertical aperture in the drawhead. It is also provided with a longitudinal slot, D, and a cam projection, E, upon its lower edge, and is suspended from a long link, F, by a ring passing through a slot, D. It is provided with a notch in its lower edge at the rear of the cam projection, into which an inner angular arm of the sliding arm, R, can pass when it is pushed inward.

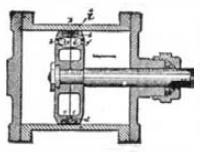
A bar, H, provided with a check stop, *b*, is held loosely and horizontally directly over the drawhead, on the end of the car or platform, by guides in which it can slide parallel with the end of the car. At or near the middle of its upper edge it is provided with a projection, beveled upward to its end, and also with handles at the ends. This bar also has a pivoted handle projecting from the end of the beveled projection, vertically to the top of the car. A sliding bar, R, provided at its outer end with a head and at its inner with a rectangular arm is held on top of the drawhead by two guide loops, the bar projecting from the end of the drawhead. An arm, T, is pivoted to the lower side of the drawhead and passes vertically through a slot in the head, and has attached to its lower projection a spring. When the parts are in the position shown in the cut they can be coupled. The drawhead, A′, holding the link, W, strikes the head of the rod, R, and pushes it toward the inner end of the drawhead, A. The rectangular arm of the rod presses against the cam projection of the lever, C, raising it and the pin, O, and carrying the upper end of the arm, T, toward the inner end of the drawhead. By this movement of the rod the pin is raised enough to let the link into the aperture, B, when it drops back to its former position and the cars are coupled. To uncouple the bar, H, is moved so as to cause the link, F, to slide up on the incline, thereby raising the lever, C, and coupling pin O, and permitting the link to be withdrawn.



An Improved Engine Piston.

Mr. John Carter Hale, of Stephens City, Frederick county, Va., has patented an improvement in pistons for steam engines, of which the annexed cut is an illustration.

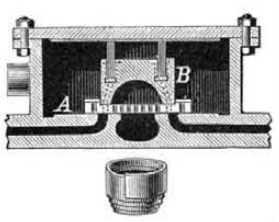
The piston is composed of two cast iron heads of equal size, having a peripheral recess, *b*, formed in a lateral annular rim, *c*, near the circumference, and adapted to be fitted together so as to make a steam-tight joint between the two rims. A lug, *d*, in one of the rims fits into a corresponding recess in the other, and at a point opposite thereto the rims are curved inward to form a ball cage, which is provided with a ball, and ports, *g* and *h*, leading through the piston heads, and a third port, leading through the rim, *c*, at the point of juncture. A groove, *i*, is formed near the edges of the rim, *c*, so as to form a continuous channel in the bottom of the recess, *b*, when the heads are screwed together. The steam packing, *k*, is a single ring, cut at a given point, and has its two ends recessed on opposite sides, so as to allow the ends to overlap each other laterally. To make this joint steam-tight a lining is secured to the inner surface of one of the ends so as to project beyond the joint, and to counteract the effects of increased thickness at this point the band is made correspondingly thick at the opposite side. It is designed that the packing shall not act as a spring, but shall be expanded solely by the action of the steam. When steam is admitted into the cylinder, at either side of the piston, a portion of it will enter through one of the ports into the cage, and thence through the third port into the groove, *i*, and the packing is expanded against the walls of the piston chamber. The expansion of the packing will vary according to the amount of the steam pressure exerted, and it will always relieve itself of strain when the steam is shut off.



A Novel Slide Valve.

A novel and useful improvement in slide valves has lately been invented and patented by Mr. William S. Hughes, of Long Island City, Queens county, N. Y., which is very clearly shown in the annexed engraving. The invention consists in volute springs combined with a slide valve in a manner to cut off a portion of the pressure, and at the same time allow automatic adjustment of the valve; also in a relief valve combined with the slide valve for the release of air compressed in the cylinder. The object of the invention is to balance the slide valves of steam engines, especially locomotive engines, and to prevent the wear and concussion produced in such engines when running without steam.

The accompanying engraving is a cross section of the valve and steam chest and an elevation of the balancing spring. A is the valve seat provided with ports, and B is the slide valve formed with an exhaust cavity as usual. The valve, B, is formed at its upper side with two annular cavities which contain coiled or volute springs, like the spring shown in the elevation in the drawing, that bear on the under side of the cover of the steam chest. The ends of the springs are filed down to insure true bearings and contact of the springs the entire circumference of the coils, and a wearing plate of hard metal is secured on the steam chest cover to prevent wear by the movement of the valve.

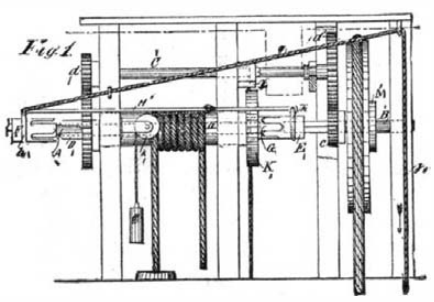


It will be seen that the springs are cylinders that cut off the area of surface which they inclose from the pressure of steam, and are proportioned to leave so much surface exposed to pressure as is necessary to hold the valve tightly to its seat against any ordinary back pressure. The springs also allow the valve to rise or rock when there is pressure caused by the engine running without steam. The side flanges of valve, B, are slotted, and the slots are covered by strips of metal held in place by flexible arms attached to the end flanges of the valve, B. These strips serve as valves that close the slots when pressed down by steam pressure, and give way to pressure from beneath, so as to relieve the main valve from the air pressure caused when the pistons are worked without steam.

An Improved Hoisting Machine.

Mr. Vernon C. Jarboe, of Wyandotte, Wyandotte county, Kan., has patented a new hoisting machine, constructed so that the power may be disconnected from direct action upon the winding drum and simultaneously applied thereto indirectly, for the purpose of increasing the lifting power of the apparatus.

In the annexed engraving the shaft, A, upon which the winding drum is attached, and a shaft, B, upon which the power pulley is secured, are journaled in the frame of the machine in a line with each other. Parallel with and above the shafts is the shaft, C, upon either end of which are fixed gear wheels, *d d′*, that receive motion from the gear, *e*, fixed upon the shaft, B. The gear, *d*, meshes with a loose gear upon



the shaft, A, and imparts motion thereto, and has upon its side a clutch, D, with which the sliding clutch, F, placed upon the square extended portion of the shaft, A, engages and imparts motion to the winding drum indirectly from the pulley shaft by the system of gearing described. The inner end of the shaft, B, is made square, and upon this portion is placed a sliding clutch, E, that engages with the clutch, G, formed upon the inner end of the shaft, A, for imparting motion directly to the winding drum. The clutches, E and F, engage and disengage with the clutches, D and G, by means of the sliding rod, H, to which the spring arms, *h h′*, which are secured around the clutches, are attached. The rod, H, is held by a weight secured to a cord which passes over the pulley, *k*, so as to engage the clutches, D and G, and to reverse this order and engage the clutches, E and F, the rod is drawn forward by the cord, *j*. Upon the shaft, A and B, are brake wheels, K and M, which are operated by suitable mechanism to control the speed of the shafts.

It will he seen that when the clutches, D and G, are engaged, the machine operates as a simple wheel and axle, and elevates light loads rapidly, and when the clutches, E and T, are engaged, the drum is operated through the medium of the gear wheels, and has slow motion and great power, and is capable of elevating very heavy loads.

MECHANICAL INVENTIONS.

Adjustable Socket Wrench.

The accompanying engraving shows an invention for which Letters Patent have been lately issued to Felix Chantrell, of Bridgeport, Fairfield county, Conn. The invention is a useful improvement in adjustable socket wrenches. The stock of the wrench is made of metal in T form, and has sockets in the ends of its three arms. It is made in two parts, the plane of division passing through the three arms, as shown in the engraving, and these parts are secured to each other, at or near the intersection of the three arms, by rivets, and also by steel bands shrunk upon the ends of the short arms.

Upon the inner side of one part of the long arm of the wrench is formed a projection which passes through and fits into a slot or mortise formed in the other part of the arm. The projection is made of such size as will give the necessary strength to resist the torsional strain upon the parts of the wrench when it is in use.

In the adjacent faces of the parts of the long arm of the wrench, near their lower ends, are formed recesses to receive a thumb wheel, which is of such size as to project upon both sides of the arm sufficiently to allow it to be turned by the thumb and fingers. A screw passes through the center of the thumb wheel, and is secured at its center to the wheel, so that the screw will be turned by turning the wheel. The screw has a right hand thread on one end and a left hand upon the other, to fit into screw holes in the adjoining parts of the wrench, so that they will be spread apart to enlarge the socket in the end of the long arm by turning the thumb wheel in one direction, and contract it by turning the wheel in the other direction. In this construction the screw assists in supporting the parts of the long arm against the torsional strain when the wrench is used.

By this device an easily adjusted, strong, and convenient socket wrench is provided at a moderate expense.

Permutation Padlock.

A large amount of money and inventive ability have been expended in making locks to secure banks and safes containing valuables against being broken into, while the common property of the house and barn is left with little or no protection from thieves and burglars except the common lock, which is little better than no protection at all.

Mr. James E. Dean, of Fishkill, Dutchess county, N. Y., has invented an improved permutation padlock that is cheap and simple, and may be used in the place of the ordinary padlock, and at the same time be more secure against picking. The invention consists of a bolt having a polygonal or cylindrical head numbered or lettered on its faces, and having about its end communicating or intersecting annular and longitudinal grooves; and in combination with this bolt, of polygonal or cylindrical ring sections, numbered or lettered on their faces, and provided with internally projecting studs, corresponding with the grooves in the bolt, the ring sections being rotary. These ring sections are coupled together, face to face, by flaring rings, as may be seen by the accompanying engraving, which is a perspective partly in section, so that they can move on each other, the design being to lock and unlock the lock by arranging the ring sections relatively to each other and to the bolt head according to keys formed by combinations of the letters or figures.

In the engraving, A represents the bolt provided with polygonal head, B, whose faces are numbered, as shown, and at its end said bolt has formed in it annular and longitudinal grooves. *c c c* are three ring sections provided internally with studs designed to enter the cylindrical and longitudinal grooves on the bolt, A. The lower ring section is closed at the bottom to prevent the discovery of the combination and the picking of the lock. If the ring sections, *c c c*, are rotated to a certain adjustment relatively to each other and to the bolt head, B, the lock may then be put over and upon the end of the bolt, A, by rotating the lock until the studs upon the ring sections successively coincide with the

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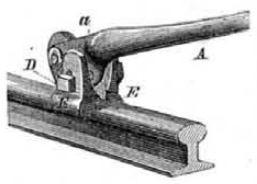
longitudinal grooves in the bolt, A, and at the same time pressing the lock upward on the bolt to lock the hasp on the staple, as shown.

Car Starter.

Mr. Charles B. Underhill, of Lancaster, Erie county, N. Y., has patented a very ingenious improvement in that class of devices that are designed to start and move cars on the rails, and is nicely illustrated by the annexed engraving.

A is a lever having in its slotted end a roller fixed on a transverse pin, the roller being designed to apply to a wheel of the car to be started. At *a* the lever is wedge-shaped in cross section, the point of the wedge being downward, and just above the end of the wedge the lever is transversely perforated to receive the fulcrum bolt, D. E E are like halves of the clamps of the starter, the lower parts of which are cut away on their insides to fit the rail. The inner faces of these halves slope upward and outward to their tips, and on their outer faces they are straight to the tops of their slotted holes, *f*, and thence to their tips are inclined outward. The fulcrum bolt passes through the holes, *f*, of the clamp, and a hole in the lever, the head of the bolt being in contact with one-half of the clamp, E, and the nut with the other. By throwing up the lever, A, to apply the starter, the broad part of the wedge is raised from between the halves of the clamp, E, and the fulcrum, D, is also raised to its utmost extent, thereby the clamp is loosened from the rail, and when thus loosened may be moved along the rail or wherever may be desired. When the starter is applied to move a car the lever is brought gradually down with its wedge portion between the clamp sections, the fulcrum bolt being at the same time pressed down in the holes, *f*, and thereby the clamps, E, are pressed outward and their jaws inward to grasp the rail, and the greater the pressure the more firmly the rail is grasped.

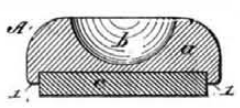


This starter is cheap, strong, durable, easily applied, and very effective.

A New Furniture Socket.

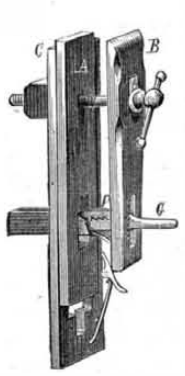
Casters placed upon the legs of furniture, by which it may be easily moved from place to place, are a great convenience, and they are sometimes also a source of annoyance, as they allow the furniture to move when it should remain stationary. This annoyance may be easily overcome by placing under each caster a device that has been lately patented by Charles Haring, of Watkins, Schuyler county, N. Y., and is illustrated by the annexed cut.

The device is a padded socket, composed of the body, that is made in circular form, with a recess in its upper surface, and a disk of rubber or other soft or elastic material, attached to the bottom by cement or other suitable means. The body is made of any durable material—such as wood, metal, or hard rubber—but iron is preferable, on account of cheapness and the weight assisting in holding the pad in place. The under side of the body is recessed to receive the disk, the annular shoulder of the recess setting down over the disk, protecting its edges and retaining it in place. The disk is made thick enough to prevent the contact of the body with the floor or carpet. In use the socket is placed beneath the furniture leg, with the caster wheel or end of the leg resting in the recess of the body. The recess prevents the leg from slipping from the socket, and the furniture is held from being accidentally moved.



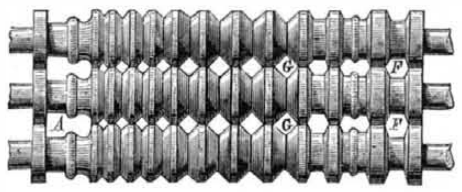
An Improved Bench Vise.

A cheap, convenient, and easily operated bench vise for carpenters' use has been lately patented by Mr. Jesse L. Parker, of Fountain City, Wayne Co., Ind. In the accompanying engraving, which illustrates the invention, A and B are the jaws of a vise, and C is a bench leg provided with a slot, to permit the up and down travel of the vise. A tenoned screw block is mortised into the jaw, B, its tenons moving in the bench leg, and its shoulders bearing against the inside of the leg. The upper screw passes into the block through the jaws, A, B, and draws them together. The screw block also serves to guide the vise up and down in the leg, C, and is held at any desired elevation by a lever, catch, and spring, upon the side of the leg. A notched treadle, G, designed for holding the lower ends of the jaws in any desired position, passes through and is pivoted to a longitudinally slotted block, F, which extends rearward through a corresponding opening in the jaw, B. The treadle extends outward from the jaw, A, for the convenience of the foot of the operator and is held in its desired position by a spring on its underside, and a catch plate on its upper side. It will be readily seen that this vise may be adjusted to any height and to any size with very little trouble to the operator.



A New Machine for Rolling Rectangular Bars from Old Rails.

Mr. John J. Thomas, of Zanesville, Muskingum county, O., has patented new and improved machinery for rolling old railroad rails into merchantable bars. This work is accomplished by a set of grooved rollers, forming passes in the shape of a pear-head rail with a thickened base, and a series of decreasing regular and irregular hexagon passes, and flat hexagon passes having recesses in the flat side, and



also a series of square reducing passes gradually decreasing in size. The accompanying engraving illustrates the series of rollers.

The rail, being thoroughly and uniformly heated, is passed through the passes, A, B, and F, and is formed into a billet, which can be passed through the grooves, G, which gradually reduce its cross-section to such an extent as may be desired.

By this means the pieces of rail are converted into bars at a single heat, as the decrease and change in cross-section takes place in such a manner and so rapidly that the iron or steel cannot cool before it has passed through the machine.

ELECTRICAL INVENTIONS.

A New System of Electrical Lighting.

An ingeniously devised combination of a voltaic arc electric lamp with an air exhauster, arranged so that a vacuum may be continually maintained about the carbons, has been patented by Mr. Amedee M. G. Sebillot, of Denver, Arapahoe county, Colorado, of which the annexed cut is an illustration.

The carbons, A A′, which are attached to carbon holders are contained in a globe, B, and are attached to pistons, D D′, fitting in the cylinders, E E′, between which the globe, B, is held, the ends of the cylinders fitting so closely against the globe as to form an airtight joint. The carbon-holding rods pass through packing boxes in the inner ends of the cylinders, E E′. Screw rods provided with milled buttons at the outer ends pass into threaded apertures in the pistons, D D′. By turning these screws the carbons may be adjusted. The screw rods are locked by screws, *a a′*. An air channel leads down through the wall of the cylinder, E′, to a tube provided with a stopcock which connects to the main chamber, M′, of the compound air pump, from which the air is continually pumped, so that when the globe and the tank are in communication there will be a vacuum in the globe, which will be maintained as the pumps operate continuously.

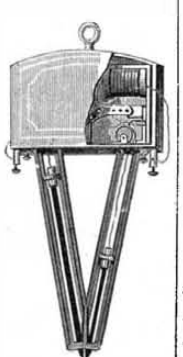
The lamp is contained within a parabolic mirror by which the rays of light are thrown horizontally and downward. This mirror is arranged in the form of an overhanging circular cornice on the top of a high tower, and a ring of the above described lamps is arranged within it and below the overhanging part. The globe of every lamp must be connected with the main tank of the air pump.

The compound air pump is composed of a series of air pumps which regularly and gradually decrease in size, so that the tank in which there is the most perfect vacuum will be the largest.

The carbon holders are connected to the poles of an electric generator of any suitable kind, and a derrick is provided for raising and lowering the device.

New Electric Arc Lamp.

We give an engraving of an improved electric arc lamp, lately patented by Mr. Henry B. Sheridan, of Cleveland, O. This lamp employs two or four carbon rods converging toward the point of combustion, and allowed to gravitate toward each other, by a friction escapement, controlled by a differential magnet placed in a shunt circuit, and affected by the fluctuations of the current.



The carbon rods are suspended by chains from drums of different diameters, the positive carbon being connected with the chain from the larger drum, and the negative carbon being connected with the chain from the smaller drum, so that notwithstanding the difference in the rate of the consumption of the two carbons, they always maintain the arc at the same point.

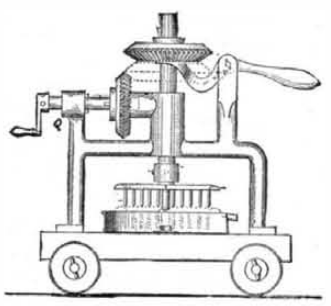
The construction is such that a strong current holds the carbons apart, and by means of a pawl and ratchet arrangement the feeding device separates them more or less, when the current is very strong; as, for example, when the carbons touch previous to lighting. In this case it separates them to form the arc, after which the regulation is accomplished for the greater part by releasing the arms as the current weakens, allowing the carbons to approach sufficiently to maintain the standard length of the arc.

METALLURGICAL INVENTION.

An Improved Amalgamator.

A novel machine for amalgamating ores for the separation of the precious metals from the waste mineral matter has been patented by Mr. Angus McKellar, of Fort Douglass, Utah, and is illustrated by the annexed engraving.

Upon a platform mounted on wheels, so that the machine may be moved about, is a double vertical standard, Q, supporting a central sleeve. Through this sleeve passes an upright vertically adjustable shaft, on the top of which is keyed a bevel gear wheel, and on the bottom of which is held by a set screw a rake consisting of cross bars having downward projecting teeth. In an upright arm of the standard is pivoted a lever, whose forked end embraces the upright shaft just below its bevel gear wheel, whereby the shaft and rake can be elevated and lowered. Into the upper portion of the standard, Q, is journaled a horizontal shaft, to the inner end of which is attached a bevel gear wheel, and to its outer a crank, through which power is applied for operating the rake. Set loosely upon the platform is a settling and amalgamating pan, having in its center a step to receive the lower end of the rake shaft when the rake is in operation. At the upper edge of the pan is a discharge spout, for the purpose of carrying off the muddy water and smaller particles, and having a screen at its inner end to prevent the escape of the sand and metal. In the bottom of the pan is from one-fourth to one-eighth of an inch of quicksilver, when ready for work, and to this chemicals may be added if desired. Powdered mineral earth then being delivered into the pan, a small jet of water is also introduced at the center, and the rake being lowered by the forked lever, so that the gear wheel of the crank shaft shall mesh with the gear wheel of its shaft, the crank is turned, and the rake is rotated until the material is mixed to the consistence of mud, when the supply of earth is shut off and a larger supply of water added, and the rake is rotated in the opposite direction until muddy water ceases to flow. The operator then skims off the upper layer of sand and ore that is free from gold. The washing and skimming are repeated several times, when the pan is removed and its contents submitted to the usual operations for separating the gold and quicksilver.



MISCELLANEOUS INVENTIONS.

New Picture Exhibitor.

An invention for exhibiting ornamental cards, and which gives more ornamental effect than is ordinarily furnished, has been lately patented by Mr. Augustus Lueckel, of Brooklyn, N. Y.

This is a combination of a folding card with a supporting frame or easel. The supporting frame is a sheet of cardboard having a portion cut out, to form a supporting leg, which holds the frame at a proper inclination.

The folding card consists of a main portion attached to the cardboard, and leaf portions attached to the main portions by flexible connection, so that they may be folded down upon the main portion, or opened out, as shown in the engraving.

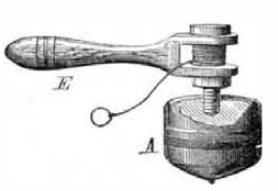
On the face of the main card is a picture, and both sides of the hinged portions are similarly ornamented, so that five separate pictures are given.

Around the edges of the body card is a bordering of ruffed or plain material, and fringe is added as a finish. The cards mounted in this way are highly ornamental, and are displayed to the best advantage.

A Novel Spinning Top.

Mr. Johnathan Hill, of New York city, has patented a novel spinning top, of which the accompanying engraving is a good illustration.

The top, A, is made of any suitable material, and is provided with the ordinary point, upon which it spins. In the center, at the top, is formed a screw hole, fitting loosely upon the screw-thread on the lower end of a spindle which passes through and runs freely in a hole formed in a slot at one end of the handle, E, and is retained in its place by a head formed above the handle, and a collar which fits tightly on the spindle under the handle.



The top is screwed to the spindle, and the spindle turned still further to wind a cord which is fastened to it in the recess of the handle. When the cord is drawn the spindle is turned in the direction to screw it into the top, and when it is wholly unwound it stops the spindle, and the momentum of the top causes it to run off the spindle and spin upon the surface, over which it is held until its momentum is exhausted.

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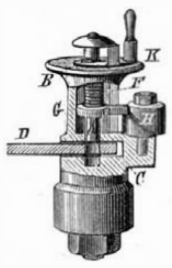
Metal Roofing Plate.

Mr. John Walter, of Nashville, Davidson Co., Tenn., has patented a new metal roofing plate for houses, that has novel features, illustrated by the annexed cut.

The plate, A, may be of any desirable size, and is formed with two parallel corrugations, *a a'*, near one of its lateral edges, so constructed that the inner corrugation, *a*, shall serve as a catch to hold another plate placed at its side, and the outer, *a'*, shall form with the inner one a gutter, *b*, for carrying off any water that may enter the seam. Adjacent to the outer corrugation is a flange, having perforations, through which the plate may be nailed to the roof. The opposite lateral edge of the plate is formed with a single broad corrugation, adapted to cover the corrugations and gutter of the adjacent plate, and its extreme edge is bent under to form a catch, which is to engage with the inner corrugation, *a*, of its adjacent plate, forming a waterproof seam. The plates are laid in horizontal layers, the upper layer overlapping the next lower one, and are provided with a horizontal corrugation, *e*, extending across nearly to the lateral corrugations, and at such a distance from the extreme top edge of the plate that the lower end of the plate overlapping it shall form a seam therewith, and by means of an upward inclination given to the upper edge of the plate, any water passing up between the plates is prevented from flooding the seam. Each plate is constructed with a central Y-shaped corrugation, and a corrugation having the shape of an arrow head located between the forks of the Y, the corrugations serving to guide the water to the right and left hand sides of the plate to the gutters, where flooding is less liable to ensue.

A New Horse Detacher.

The invention illustrated by the annexed cut is a device to facilitate the attaching and detaching of the traces of horses from the whiffletree, especially for detaching in cases of danger when the horses run or fall, and is a spring actuated bolt for holding the traces, which can be withdrawn by devices operated from the driver's seat, and releasing the horse instantaneously. With this device many accidents of daily occurrence might be prevented and many lives saved. A bolt, A, slides in a casing, B, and is provided with a socket, C, for the trace, D, the end of which must be in a horizontal position. The bolt must be of such length as to cross the socket, and is provided with a removable head, which rests on the top of the casing when it is in its lowest position. A spiral spring, F, surrounds the bolt and rests against the underside of the top of the casing, and against an annular ridge, G, on the bolt, the spring pressing the bolt downward. The ridge has a stud projecting through a vertical slot in the casing, which rests on a spiral shoulder of a small cylinder, H, pivoted on a projection of the casing, and has an arm, J, extending backward from the whiffletree. A casing, B, is fastened to each end of the whiffletree. A latch lever, K, provided with a handle, and a vertical stud, M, is pivoted on the top of the casing, B. The casings at either end of the whiffletree are connected by a rod, N, through the levers, J, one of the levers having an extension, N'.



To fasten the traces to the holders, the cylinder, H, is rotated, by means not shown, carrying up the studs, G, thereby raising the bolts, under the head of which the stud, M, is thrown by the latch, K, and permitting the trace to be inserted in the socket, C. The latch is then reversed and the bolt is forced through the opening in the trace by the spring, F. All that is necessary in case of danger is to rotate the cylinder, H, as before, when the bolts will be raised and the traces released. The above device is patented by Heinrich Fleischhauer, of Berlin, Germany.

Improvement in Shirts.

This improvement relates to certain novel features applicable to dress and fancy shirts of flannel, in part or as a whole. This shirt is of the usual construction except as hereinafter described. As shown by the accompanying engraving, openings are formed in the lower part of the shirt body, front and back, instead of at the sides as usual. These openings extend from the bottom any desired distance upward, and by their position allow the shirt to open or give way sidewise, or in the direction most natural and convenient. By this construction the shirt may be made longer and still readily kept down to its place, and there will be no danger of the shirt being torn by strain. The shirt is also made with an open bosom formed to button by means of inner flaps (which do not show in the engraving) attached at the inside. The outer flaps, formed by the main body of the garment, are made with eyelets through which a lacing cord is strung, so that they may be drawn up as closely as desired. This lacing is more reliable and stronger than buttons, and gives an ornamental appearance to the bosom that is so desirable on fancy flannel shirts.

The shirt is provided with a collar or neck band of ordinary construction, and between the sides of the doubled strip forming the band a collar is attached, so that the collar, when turned inward, hangs straight below the band, and the band may be used with a separate collar as usual. The collar may also be turned outside for use in place of a separate collar.

With dress shirts this reversible collar avoids the necessity of changing the garment when the collar is slightly soiled, as the fixed collar can be turned in and another put on.

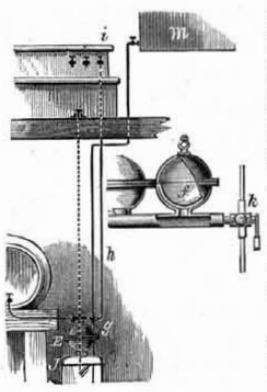
With flannel shirts it gives the advantage of a collar of the same material, which, with a lawn-tennis shirt, can be worn in the field and afterward readily replaced by another when the appearance of ordinary dress is desired.

The above novel improvement in shirts is the invention of Mr. Isaac Schneer, of New York city, for which he has obtained a patent.

Improved Apparatus for Raising Beer, etc.

Messrs. Peter J. Catterall and Edward Birch, both of Manchester, Lancaster county, England, have patented, both in this country and in England, an improved method and apparatus for raising liquids from vessels in a cellar to other parts of the building, without the exertion of hand labor. This object is attained by the device illustrated by the accompanying engraving.

The tap of a barrel containing liquid to be raised, is connected one end of a flexible tube, the other end of which is connected to a back pressure valve, communicating with the upper part of a chamber, E. This chamber is made in halves, and a diaphragm, *f*, of flexible material is placed between the two halves, which are then bolted together. The diaphragm effectually prevents any liquid in the upper part of the chamber from mingling with the water in the lower. The upper part of the chamber communicates through the valve, *g*, and pipe, *h*, with the tap, *i*. The lower part is fitted to a water chest, J, to which water is admitted through a three-way valve, *k*, and pipe from the cistern, *m*. The tap has a weighted lever, and to its lower part is screwed a waste pipe. To the lever is attached a cord, the other end of which is fastened to a treadle near the floor below the tap, *i*.



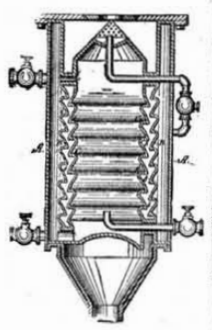
The liquid to be raised flows through the flexible tube and back pressure valve into the chamber, E, forcing the diaphragm, *f*, into the position shown in the engraving. When the liquid is to be drawn the tap, *i*, is opened, the treadle is operated so as to turn the three-way tap, and water is admitted into the lower part of the chamber, E, the pressure of the water forcing up the diaphragm, and the back pressure valve preventing the liquid from flowing back to the vessel, it is forced through the pipe, *h*, to the tap, *i*.

When sufficient liquid is drawn the treadle is released, the weighted lever turning the three-way valve, shutting off the water from the chamber, E, and allowing it to escape at the waste pipe.

A Wheat Steamer and Heater.

In the manufacture of flour of fine grade the great desideratum is to remove the hull of the wheat as completely as possible. In order to do this it has been found most expedient to toughen the hull so that it may be removed in comparatively large pieces. A device lately patented by Mr. Cyrus T. Hanna, of Pittsburg, Allegheny county, Pa., and shown in the accompanying engraving, seems admirably adapted to do this work.

A is an outside cylinder, and B C are inside cylinders of an apparatus for steaming and heating wheat for the purpose of toughening and expanding the hull preparatory to grinding. A pipe conducts steam into the center of the cylinder, C, from which it passes through tubes into the annular space between the cylinders, A B, insuring an even heat in both the inner and outer cylinders. The grain enters the apparatus at its top and passes through the annular space surrounding the inner cylinder, C, thus passing between two metal surfaces which are evenly heated. As a consequence the grain also becomes heated before reaching the conical discharge end of the apparatus. The grain is deflected alternately in opposite directions by circumferential corrugations, whose upper sides are long and inclined and undersides are short and abrupt, and alternate in positions, so that the wheat will slide from one on to the other as it descends through the apparatus.

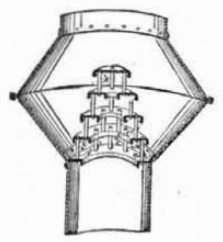


The wheat is first moistened by steam emitted from the perforated cone in the top of the device, and the hull is toughened, and the subsequent heating serves to dry out the surplus moisture and leave the hull expanded and in a condition to admit of its easy removal by the grinding stones.

Spark Arrester.

A novel spark arrester for locomotives, patented by Mr. George S. Cook, of Windsor, Nova Scotia, is very clearly shown in the engraving, which is a central vertical section of a smokestack containing the spark arrester.

As will be readily seen the device can be easily secured in smokestacks of ordinary construction, and easily removed for repairs or other purposes. The invention consists of a series of peculiarly shaped rings placed one above the other. The lower ring, A, is formed with a flange on its circumference, which is provided with holes for bolting or riveting it to the smokestack. The inner edge of this plate is formed with a downward flange, to form an annular chamber to collect the sparks on the under side of the plate.



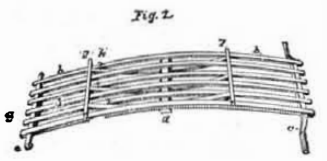
Supported by and above this ring there is an annular plate of smaller diameter, formed with outside and inside downward flanges. Above this plate and supported by posts is another similar plate, only smaller in diameter, and above this is still another of similar description, but still smaller. Above this last plate there is a solid plate formed with a downward flange on its circumference, which is placed above the central passage formed by the central openings through the rings, and arrests the sparks that pass the annular rings.

By this construction all the sparks are arrested and deflected back into the stack, while plenty of room is given for smoke, steam, and draught.

An Improved Stiffening Frame for Buckboard Wagons.

An improved buckboard for wagons is patented by Messrs. Israel Joubert and Sydney W. Yattau, of Port Henry, Essex county, N. Y., and is clearly shown in the annexed drawing.

This is a buckboard of the usual construction, composed of a series of parallel and upwardly curved spring slats, having openings between them and secured to transverse end bars and a middle cross bar. The transverse bars are secured to the fore and hind axles of a wagon, and the buckboard serves as a reach for connecting the axles and as a spring. An improved stiffening frame, composed of a series of parallel wooden slats that are curved downwardly or in an opposite direction to the spring slats of the buckboard, are secured at their ends to transverse bars to which the bottom of a wagon body is secured. The spring slats of the stiffening bar are inserted in the openings between the slats of the buckboard, and they are secured at their middles by the middle transverse bar of the buckboard, while the transverse bars of the stiffening frame rest on the slats of the buckboard.

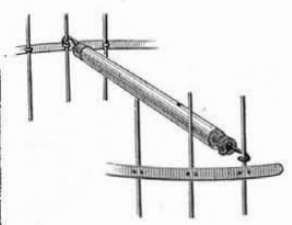


This construction materially strengthens and stiffens the spring of the buckboard and renders it more durable, and the wagon body can be elevated as desired by shortening the stiffening frame.

A New Bird Cage Perch.

Mr. Joseph Bagot, of Brooklyn, N. Y., has invented an improvement in perches for bird cages. The perch is formed of rubber, and has hooks attached to its ends for fastening the perch between the wires of the cage. Ferrules are placed upon the ends of the perch and catches inserted in the ends; by this construction the perch and catches are firmly connected. The catches have hook-shaped outer ends and wedge-shaped inner ends.

In the engraving shown, A is the rubber perch, of suitable diameter, preferably of tubular form, and of such length as the size of the cage may require. Upon the ends of the perch are placed ferrules, also catches, to engage with the bars of the cage. These catches are extended inside the ends of the perch and are made wedge-shaped, the small end of the wedge toward the catch.



The manner of uniting the perch and catch is so well shown in the accompanying engraving that it needs no further explanation.

The perch should be made of such length that when applied to the cage the tension will prevent its sagging by the weight of the bird. This perch has important advantages over the ordinary perch, as any parasite that may infest the birds will crawl into the interior of the hollow perch and can be readily destroyed. The perches are easily removed and cleaned, and being soft do not injure the feet of the birds. The elasticity of the rubber allows the perches to be stretched so that they can be applied to different sized cages.

A Novel Automatic Alarm Signal.

A novel alarm operated automatically, to give a series of explosions at stated intervals of time, is patented by Hiram A. Eaton, of Manchester, Kennebec county, Me. The construction of the signal is shown in the accompanying cut.

In a box, E, there is a series of barrels that load at the muzzles and are discharged by means of percussion caps. They are secured in a cast metal breech block that is formed

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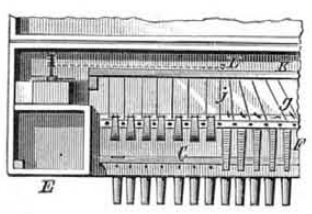
with a series of nipples upon which caps are placed for explosion, the nipples being perforated to conduct the flame from the cap to the powder in the barrels. The block is so attached to the hinged board, C, that the barrels may be tipped up entirely within the box, which position they will occupy when not in use. When in use the barrels are tipped down, so that the muzzles will project out of the box, and the nipples are in position to be struck by the springs, F, formed on their under side with projections that act as exploders for the caps. These springs are clamped at their rear end to the board, C, and may be bent upward and backward to be held and released by proper devices.



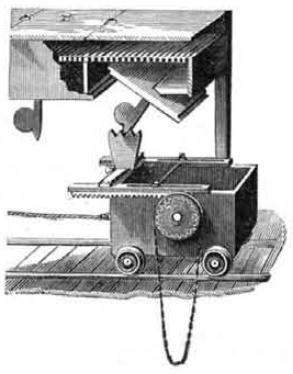
When they are cocked they are held in that position by the linked wires, *g*, and the pivoted arms, *j*, the wires being of such length that they will be retained under the rods, *j*, when they are at right angles with the wires, but will be released when the rods are moved to a greater angle, and thus the springs are released. The moving the rods for the release of the wires is accomplished by the waveling block, L, fitted in suitable ways, formed in the slotted plate, K. The block is moved by the clock, M, attached to it by a cord passing over the spindle, *l*, which is turned by the hour post of the clock. Attached to the spindle, *l*, is a cord and weight, which, when the traveling block is carried to the end of the slotted plate, will be wound up to assist in returning it.

The explosions will occur at regulated intervals, which may be varied by increasing or decreasing the speed of the spindle, and the device may be used as a fog or other signal, and is especially useful in frightening away mischievous birds from corn and rice fields, and requires no attention except to wind the clock and charge the barrels.

Trunk for Cotton Openers.

A simple and novel device for cleaning the trunks in which the dust and sand are collected that drop from cotton as it passes from the opening machine to the picker, is shown in the accompanying engraving.

The trunk of this cotton opening machine has a grating, and its bottom is composed of a series of pivoted boards, which have on their under sides projections to which are attached weights, which keep the sections in a horizontal position. A car runs on tracks or rails below the trunk. A cam provided on its outer end with a number of teeth is attached by a bar to two cogged end bars engaging with the cog wheels on the end of the shaft. A sprocket wheel is mounted on the shaft, and a chain passes over the wheel down to the floor of the room in which the trunk is located.

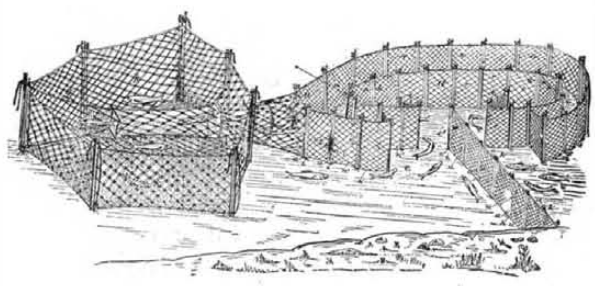


When the cotton passes through the trunk the sand and dust fall through the grating upon the tilting sections and accumulate. The car is drawn forward, causing the cam to strike the projection on the under side of the section, causing it to tilt, the sand and dust sliding down the section into the car. As the cam is toothed it will vibrate the sections, causing the sand and dust to slide off more rapidly. To prevent the dirt from accumulating at one end of the car the cam may be adjusted to different positions by rotating the sprocket wheel by means of the chain moving the racks and cam forward or backward more or less.

The patentees of this device are Messrs. Patrick Rowe and James M. Scanlan, of Lowell, Middlesex county, Mass.

An Improved Fish Trap.

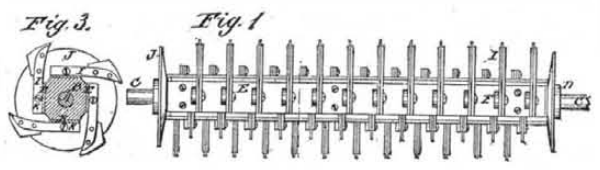
In the accompanying engraving is shown a new fish trap patented by Mr. Major B. Marshall, of Vienna, Dorchester county, Md. This trap is formed by driving a series of stationary poles in the bed of a stream near one of its banks,



so as to form an outline, preferably of spear-head shape, two concentric oblong figures provided with openings in their sides, lying opposite each other, and a wing leading from the bank of the stream to the openings, as shown in the engraving. Alongside and parallel to these stationary poles is set a series of runner poles in the bed of the stream. A net, closed at its sides and bottom and conforming to the form of the spear head, is provided at each of its angles, at the bottom of the net, with cords, *l*, which pass through holes in each of the runner poles near the bottom of the pole. The cords are then passed upward and secured to the stationary poles. The upper edge of the net is also secured to the stationary poles. By this construction the net can be drawn down into position by the cords, and when it becomes filled with fish the cords may be unlashed from the stationary posts and the net raised and the fish removed. The outer oblong figure formed by the stationary and runner poles is inclosed on its outer side by a net secured at its upper edge to the stationary poles, and at its lower edge to the runner poles. By the peculiar form of the oblong nets, and by the leader placed from these nets to the shore, the fish in the stream are turned into a series of channels that lead into the spear-head shaped net through a netted funnel which passes through an opening in the end toward the oblong nets.

An Improved Cylinder for Hominy Mills.

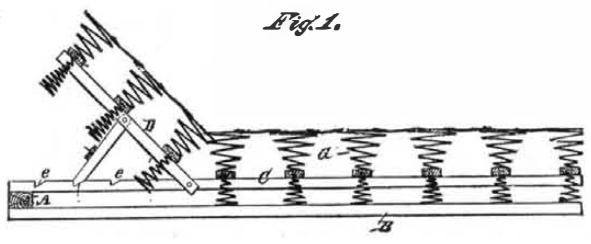
Mr. Theodore Hudnut, of Terre Haute, Vigo county, Ind., has patented an improved form of cutter carrying cylinder shafts, and modes of attaching cutters thereto, of which the accompanying engraving is an illustration. An iron or steel shaft, of suitable length and size for the purpose, has fitted upon it a wood shaft that is as much shorter than the iron shaft as is necessary to have the latter project to form journals, upon which it revolves and to receive gearing for turning it. The wood shaft is secured to the iron by means of collars at its ends that are keyed to the iron shaft and bolted to the wood, and has four or more plain sides, each side having a metal plate attached to it. These plates have lugs at intervals of the same distance apart it is required to have



the cutters, and are arranged transversely to the plates, and the lugs of one row are placed in such relation to those of the next row that they form broken spirals around the shaft. The cutters are steel plates the inner points of whose cutting edges project over a true circle struck from the center of the shaft, are bolted to arms between them, and the arms are bolted to the lugs on plates of the shaft, being laid across said plates, so that they are confined against turning on the bolts by the plates. The collars of the shafts have broad plano-convex plates attached that keep the grain away from the bearings and in contact with the cutters.

A Jointed Spring Bed.

Mr. Clinton S. Colgrove, of Winchester, Franklin county, Tenn., has patented an improvement in spring beds, of which the annexed engraving is an illustration. The frame is composed of end crossbars, A, at head and foot, side bars, B, and intermediate bars that are secured at their ends upon the upper side of the crossbars, A, the side bars, B, being secured to the under side of the same. At the head of the frame the intermediate bars, C, are formed with the notches, *e*, and to the outside of these bars are hinged arms, D, that are provided with hinged pawls, the lower ends of which engage in the notches, *e*, of the intermediate bars, for raising and supporting the head of the bed bottom. These

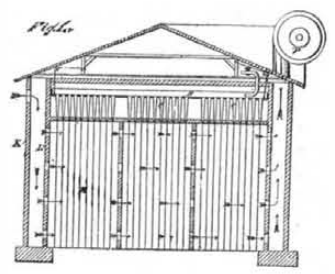


pawls are connected by a cross-piece to cause them to act together, as one pawl or brace. Across the bars, C, and the arms, D, are placed slats upon which the coiled cone springs, G, are placed. Between the ends of the slats and the side bars, B, are placed the series of side bottom springs which support the ends of the plate. After the coil springs, G, are secured upon the slats of the bed bottom, they are coupled together by wires which are bent to form a square and to interlace with the upper coils in such manner that four coils are bound together by each of the squares, which are united to the coils by twisting in the ordinary manner, making an effective, easily applied, cheap, and firm coupling. By means of the arms, D, and their pawls, the head portion of the bed bottom can be easily raised to any height to suit the occupant, or may be lowered on a level with the main portion, thus providing a bed bottom that is very complete and cheap.

Improved Ice House.

An ice house capable of freezing large blocks of ice without the use of artificially cooled air in the house itself, is patented by Arthur von Krause and Mathias Kuhnen, of Blauveltville, Rockland county, N. Y.

The device is illustrated by the accompanying engraving, in which is shown an ice house constructed with a water tank, B, in its upper part, the tank being provided with a series of slender downward projecting funnels, the centers of which are separated from eight to twelve inches each way. The lower ends of the funnels fit in apertures, in a horizontal partition arranged a short distance below the tank, and forming the top of the ice chamber, E. From each funnel a wire extends down to the bottom of the ice chamber, being supported by the funnels. The house is constructed with outer and inner walls, K, L, an air space being formed between them. The wall, K, has an opening near its top, and L has a series of openings from top to bottom. A suction fan, P, is provided to draw the air out from the building.



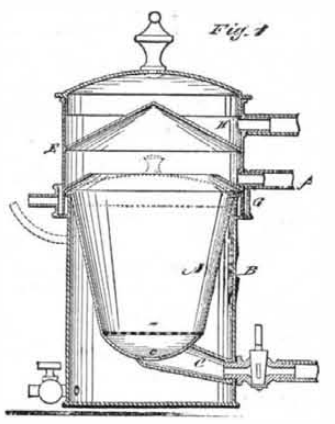
When the fan is operated it will draw the air out of the air chamber, E, and fresh cool air will enter through the openings, K, L, in the walls, circulating through the ice chamber. Water from the tank will flow through the funnels, only sufficient being admitted to the tank to cause the water to flow down the wires in thin layers. The cold air circulating in the chamber causes the water on the wires to congeal, and the layers gradually thicken until the space between them is filled. A solid block of ice eight feet square has been formed in this manner at 34° Fahrenheit.

Combined Percolator and Still.

The accompanying engraving shows a central vertical section of an improved combined percolator and still, which is the invention of Mr. Byron Fennor, of Westfield, Chautauqua County, N. Y., who has recently received letters patent for it.

It is often a great convenience for persons who are obliged to distill and make decoctions to have an apparatus that is not complicated that may be used for either purpose and still be effectual. The device shown is of this kind.

The percolator, A, in which is placed the material from which the strength is to be obtained, is cone shaped, and formed at the upper edge with a flange, by which it is suspended in the heating tank, B. The bottom of the percolator has an opening which communicates with the lateral tube, C. This tube registers with a hole in the tank, and a flanged stop cock is screwed into the end of it, which serves to keep the percolator in place, and make a tight joint over the hole in the tank.



A perforated diaphragm is placed in the bottom of the percolator which prevents the materials used from obstructing the flow of the menstruum from the bottom.

The still attachment, E, is of larger diameter than the tank, and when in place the bottom of it rests in the annular chamber which surrounds the top of the tank, and should be filled with water when the still is used to seal the joint between the two parts of the apparatus.

A short distance above the lower edge of the still attachment a cone-shaped flange is attached, which forms an annular gutter around the inside of the still, and conducts the distillate which flows from the condenser to the pipe, *f*.

The condenser is formed by securing a conical partition below the upper edge of the still and forming the receptacle, H, in which there is water or ice, and by which the vapors that arise from the percolator are condensed and flow into the gutter and out of the pipe, *f*.

When the device is used for any purpose where heat should be maintained, water is admitted to the tank, B, through the pipe, *f*, and heat applied to the tank, being communicated to the percolator only through the medium of the water.

When the still is removed a cover, shown by dotted lines, may be used.

While this invention is here shown as adapted to pharmaceutical uses, it is obvious that it may be built upon a large scale and used for other purposes.

A hair-pin which, when inserted in the hair, will so grasp and hold the lock or mass of hair inclosed within the prongs that the hair-pin will not be liable to drop or work out from the hair, has been patented by Mary T. Foote, of Boston, Mass. The ends of the hair-pin are first bent out and then in toward each other, so as to form at the point a clasp which seizes and holds a lock of hair, and the exterior shoulders of which bent portion also prevent the pin from slipping out.

Mr. Thomas A. Andrews, of Seagoville, Texas, has patented an improved coffee and spice mill. The invention consists in a coffee and spice mill having a hopper provided with arms for attaching the mill to a wall and for supporting the gear-wheel formed upon it, an inner cone-burr formed solid with the hopper, an outer shell-burr suspended from and swiveled to the inner burr by a cross-bar, rod, and handnut, and the gear-wheels and crank for rotating the outer burr

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Ask for Hard Rubber Triangles, Curves, Scales, Squares, etc., made by *Keuffel & Esser*; the best drawing implements out; all warranted true; exchanged if not so. Don't buy imitations.

Chicago News.—Messrs. Armour Dalc & Co.'s immense new corn sheds, cor. of Sixteenth St. and Oakley Ave., are being roofed with H. W. Johns' Asbestos Roofing. More than fifty thousand square feet of roofing are required.

Manufacturers and Patentees of Meritorious Articles should write J.M.M. Conrad, 232 Baltimore st., Baltimore, Md., who has special facilities for introducing new goods.

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"T. New, 32 John St., New York, has sold and applied over fifty million feet of his Prepared Roofing, the major part being placed upon manufacturing establishments." —SCIENTIFIC AMERICAN.

Agents Wanted.—None but intelligent and energetic need apply. Must furnish good recommendations, or no notice will be taken of applications. Exclusive territory will be given up to May 15, 1882. Agents are now making from $10 to $15 a day. Address, for terms, The Infallible Coin Scale Co., 267 Broadway, New York city.

Improved Skinner Portable Engines. Erie, Pa.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N.H.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N.J.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Cope & Maxwell M'f'g Co.'s Pump adv., page 263.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 252.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

List 27.—Description of 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S.C. Forsaith & Co., Manchester, N.H., and N.Y. city.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 270.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil

The Sweetland Chuck. See illus. adv., p. 270.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

4 to 40 H P. Steam Engines. See adv. p. 285.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv., page 220.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Brass & Copper in sheets, wire & blanks. See ad. p. 285.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Paragon School Desk Extension Slides. See adv. p. 285.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Ball's Variable Cut-off Engine. See adv., page 286.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 286.

Patent Key Seat Cutter. See page 285.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau street, New York.

Supplee Steam Engine. See adv. p. 221.

Lehigh Valley Emery and Corundum Wheels are acknowledged to be the safest, freest cutting, and most durable wheels in use. Write for prices, stating sizes you use. L. V. E. W. Co., Lehighton, Pa.

Drop Hammers, Power Shears, Punching Presses, Die Sinkers. The Pratt & Whitney Co., Hartford, Conn.

Saw Mill Machinery. Stearns Mfg. Co. See p. 286.

NEW BOOKS AND PUBLICATIONS.

THE STUDENT'S GUIDE IN QUANTITATIVE ANALYSIS. By H. Carrington Bolton, Ph.D. New York: John Wiley & Sons.

This guide is intended as an introduction to Fresenius's "system," as used in the Columbia School of Mines. It gives specific directions for making thirty-six typical analyses, and appears to be well suited to its purpose of smoothing the way to an intelligent use of the more difficult text books named.

THE SCIENTIFIC BASIS OF NATIONAL PROGRESS, INCLUDING THAT OF MORALITY. By George Gore, LL.D., F.R.S. London: Williams & Norgate.

Dr. Gore's thesis is that nations advance by new knowledge. The investigator discovers some new matter, combination, fact, or law; the inventor promptly applies it to the advancement of national wealth and power. The investigator and inventor may be one person; but in all cases the discovery precedes the application. And while the application brings wealth to the inventor, the investigator, pure and simple, usually gains little or nothing. Hence the necessity of making special provisions for the promotion of original scientific research, the direct source of the new knowledge whence comes all national progress, moral as well as material.

THE OCCULT WORLD. By A. P. Sinnett. Boston: Calby & Rich. $1.

Mr. Sinnett writes very earnestly and confidently of the magical power and knowledge of the adepts of "Occultism;" of the Theosophical Society and their recent performances in India; and of the teachings of occult philosophy. He seems always on the point of telling something credible, but he never does. The rational mind of the West, unlike that of Asia, is more impressed by evidence than by sheer assertion, however bold; and it will require something more than tricks with cigarettes and saucers to convince the Western World that the adepts of "occultism" have unlimited knowledge and power to work miracles at will.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will **not** be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) Mrs. S. M. A. asks: What kind of tools are commonly employed in the manufacture of artificial flowers? A. The principal tools used by artificial florists are: Stamps, an arrangement of knives of various sizes and shapes by means of which leaves and petals are cut out. The material to be shaped is laid, folded several times, upon a leaden table, and the stamp is driven through it with a hammer or mallet. This part of the work is usually done by men. Moulds called veiners, as the name indicates, employed to vein the leaves; burnishers of glass or agate give the leaves the appearance of most real foliage and flowers. As a rule, the florists' fingers, guided by taste and skill, are found better than other mechanical appliances. The best flowers are painted by hand. See "Dictionnaire Universel du XIX. Siecle," Larousse, art. "Fleurs Artificielles;" and "Art of Making Paper Flowers," by Mrs. Bartlett (New York).

(2) F. A. A. asks: Do you know of any metal or combinations of metals that will not expand and contract with the heat and cold, and which will have a degree of hardness equal to steel drawn to a low blue? I think I have heard that palladium is not affected. A. We know of no such metal or alloy. Palladium, in common with other metals, is alterable by variation, of temperature. Consult Guitter's "Metallic Alloys."

(3) J. V. C. asks: What size engine will I need to drive a portable saw mill for sawing three foot maple logs? A. It will depend upon the quantity you wish to saw per day. You may use a 15 horse engine or a 40 horse engine. A good 20 horse power engine will saw about 10,000 feet per day.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. H. G.—No. 1. Quartz and pyroxene. No. 2. Altered quartzose rock, containing a little selenite. No. 3. Red jasper. No. 4. Vein quartz with calciferous clay selvage. No. 5. A ferruginous quartz rock. Nos. 2, 4, and 5 may contain traces of precious metals. Assays will be necessary to determine this.—W. M. E.—It is an impure hornblende rock and probably contains nothing of value.—A. E. U.—Sample of "fiber" received, but no letter.—H. Z.—Hematitic argillite, containing a small quantity of molybdenite.—H. A. I.—It is a common clay slate—not what is sometimes called "blossom." It cannot be strictly considered as an indication of coal.—Rev. H. C. S.—It is a nodule of partially altered iron pyrites, iron sulphide. Not valuable.—J. V. McC.—It is sulphide of iron, pyrites, of very little value.—R. W.—The ocher is of fair quality, but somewhat coarse and gritty. It will be necessary to grind it finer. Address some manufacturer of paints.

COMMUNICATIONS RECEIVED.

On the Liver Fluke. By R. W. S.

On the Explosion of a Sawmill Boiler. By H. J. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 18, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Adding machine, F. Plumb 256,591
Advertising table, W. Wilson 256,780
Amalgamator, C. Pontez 256,733
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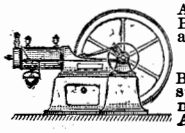

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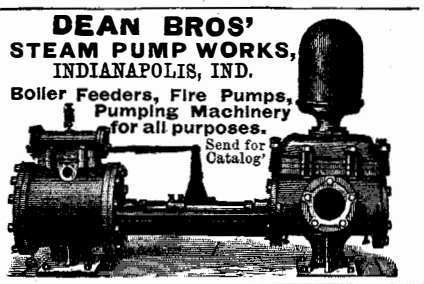

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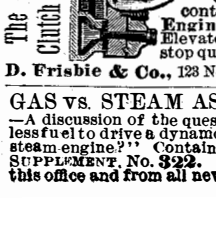

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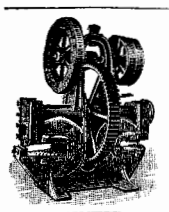

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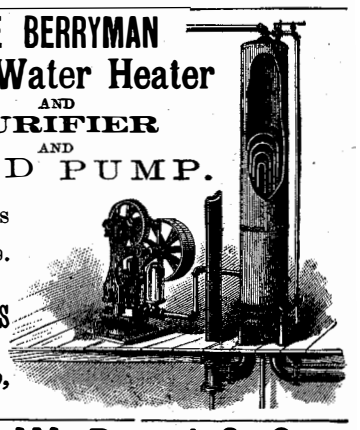

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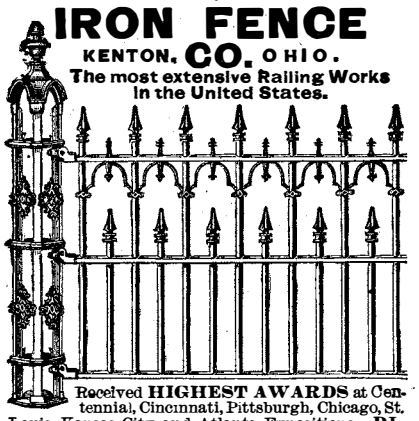

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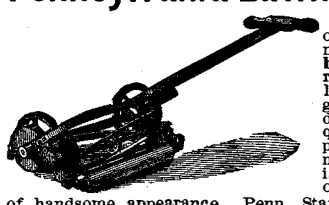

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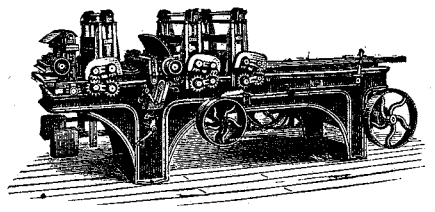

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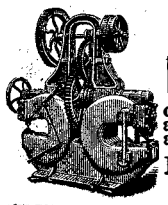

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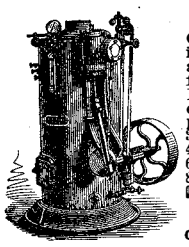

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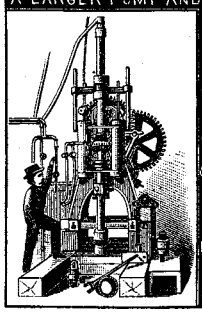

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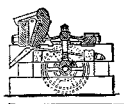

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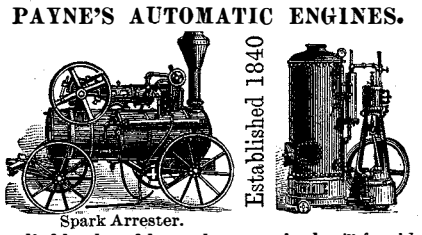

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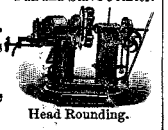

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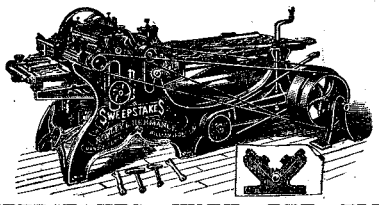

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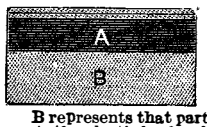

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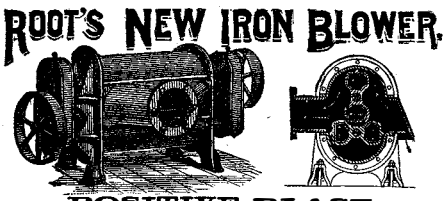

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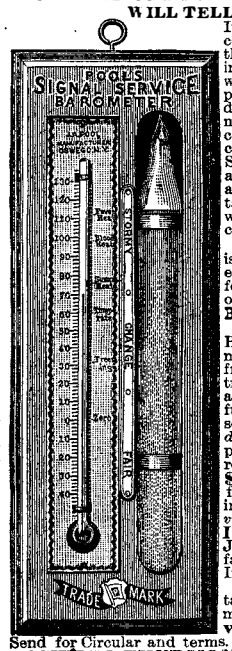

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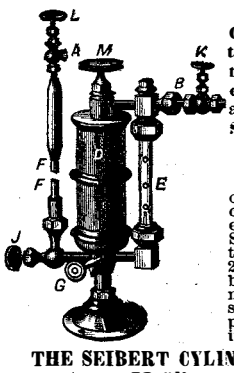

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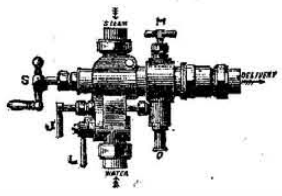

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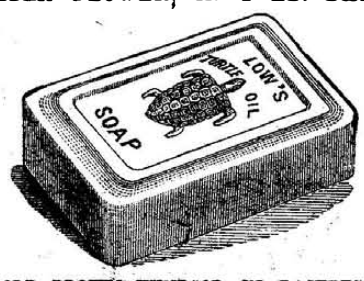

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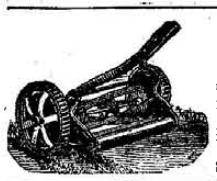

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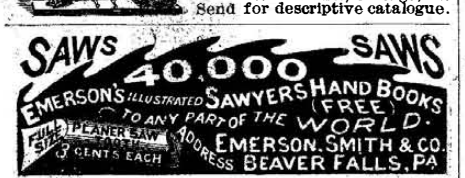

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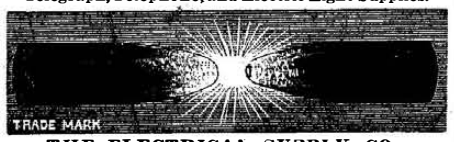

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Address CHALMERS SPENCE COMPANY,
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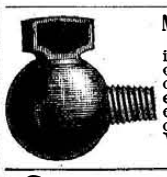

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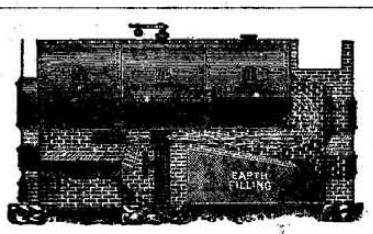

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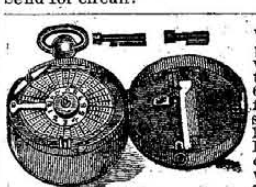

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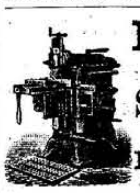

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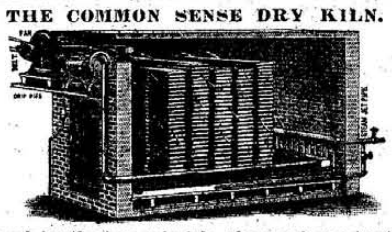

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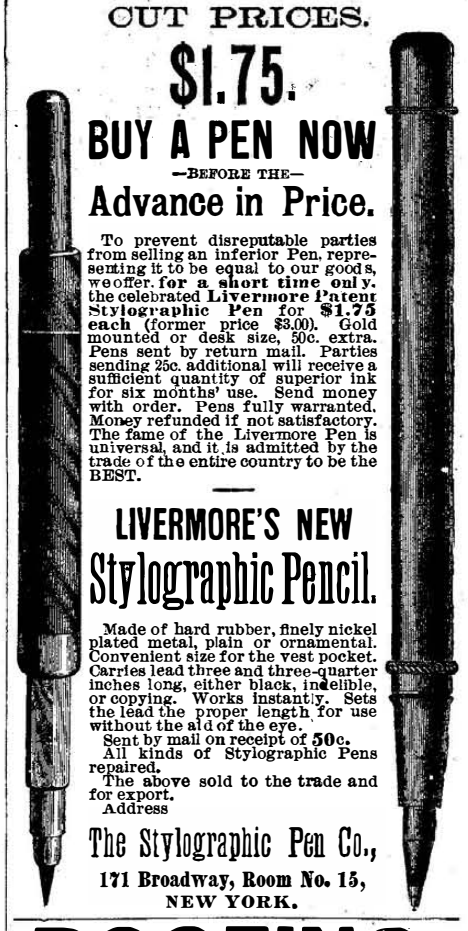

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PRINTING INKS.
THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts. Philadelphia, and 59 Gold St., New York.

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